

founded in 1832

RAILWAY LOCOMOTIVES AND CARS

Transportation
Library

JANUARY 1953

FOR OFFICERS AND SUPERVISORS RESPONSIBLE FOR DESIGN, CONSTRUCTION AND MAINTENANCE OF MOTIVE POWER AND ROLLING STOCK

formerly
Mechanical and
Electrical Engineer

D. Diesel Shop
at
ington, W. Va.

case
essions

D. Centralizes
ers to
et Diesels

ern Pacific
ic Shop at
Tacoma, Wash.

'Em Rolling
• Simple
y Circuits

and
rake
tions
Answers

Devices

UNIVERSITY
OF MICHIGAN

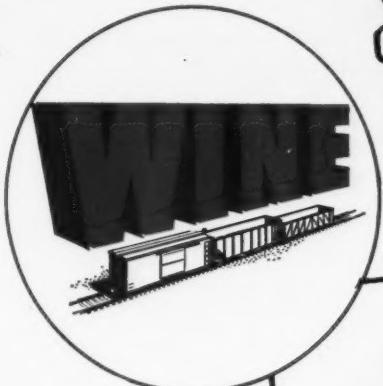
JAN 26 1953

TRANSPORTATION
LIBRARY



**One man
DOES THE WORK
OF FIVE!**

**WHEN YOUR
GONDOLAS
ARE EQUIPPED
WITH ...**



**DROP END
BALANCERS**

THE WINE RAILWAY APPLIANCE COMPANY • TOLEDO 9, OHIO

Transportation
Library

TF
1
.R16
V.127

TRUSLOCK

REPORTS TO THE INDUSTRY . . .

LESS than 24 months after the first announcement was made of the Truslock Demountable-Head Brake Beam, 41 railroads and private car operators are using this ultra-modern No. 18 brake beam for hangered-type trucks.

Ten years ago it was the Unit Brake Beam that captured the imagination of forward-looking mechanical men — and now Truslock shows every indication of becoming another outstanding champion in the field of freight car brake rigging.

Thus, for the second time in a single decade, history repeats itself, and another revolutionary development introduced to the industry by this company is well on its way to unchallenged leadership.

BUFFALO BRAKE BEAM CO.

NEW YORK • BUFFALO • HAMILTON, ONT.

Dasher 1953 in back
before ads.

JANUARY, 1953

VOLUME 127

No. 1

RAILWAY LOCOMOTIVES AND CARS

Founded in 1832 as the American Rail-Road Journal.

Simmons-Boardman Publishing Corporation:
James G. Lyne, President, New York; Samuel O. Dunn, Chairman Emeritus, Chicago; J. S. Crane, Vice-Pres. and Sec., New York; C. Miles Burpee, Vice-Pres., New York; John S. Vreeland, Vice-Pres., New York; H. H. Melville, Vice-Pres., Cleveland; C. W. Merriken, Vice-Pres., New York; John R. Thompson, Vice-Pres., Chicago; Wm. H. Schmidt, Jr., Vice-Pres., Chicago; Fred W. Smith, Vice-Pres., Chicago; Robert G. Lewis, Asst. to Pres., New York; Arthur J. McGinnis, Treasurer, New York; Ralph E. Westerman, Asst. Treas., Chicago.

C. B. Peck,
Editor, New York

H. C. Wilcox,
Managing Editor, New York

A. G. Oehler,
Electrical Editor, New York

E. L. Woodward,
Western Editor, Chicago

C. L. Combes,
Associate Editor, New York

G. J. Weihofen,
Associate Editor, Chicago

Lillian D. Milner,
Editorial Assistant, New York

C. W. Morriken, Jr.
Business Manager, New York

Editorial and Executive Offices: 30 Church street, New York 7, and 79 W. Monroe street, Chicago 3. Branch offices: Terminal Tower, Cleveland 13; 1081 National Press bldg., Washington 4, D.C.; Terminal Sales bldg., Portland 5, Ore.; 1127 Wilshire bldg., Los Angeles 17, Cal.; 244 California St., San Francisco, Cal.; 2909 Maple avenue, Dallas 4, Tex.

Published monthly by Simmons-Boardman Publishing Corporation at 1309 Noble St., Philadelphia, Pa. Entered as second-class matter, April 19, 1949, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscriptions payable in advance. Postage free. U. S., U. S. Possessions and Canada: Railroad employees—One year \$2, Two years \$3. Other than railroad—One year \$4, Two years \$7. Other countries in Western Hemisphere: One year \$5, Two years \$10. All other countries: One year \$7, Two years \$14. Single copies 50 cents. Address Robert G. Lewis, Asst. to Pres., 30 Church Street, New York 7.



Railway Locomotives and Cars is a member of the Associated Business Papers (A.B.P.) and the Audit Bureau of Circulation (A.B.C.) and is indexed by the Industrial Arts Index and also by the Engineering Index Service. Printed in U. S. A.

Universal Railroad Electrification? 49

MOTIVE POWER:

The C. & O. Diesel Shop at Huntington	50
Holds Fork Rod While Pulling Blade Rod	56
Crankcase Explosions	58
Crankshaft Rotating Device	62
B. & O. Changes Glenwood Shop into Diesel Repair Center	63

CAR:

Table Speeds Up Sorting of Small Parts	55
Burning Wood Shavings Cuts Fuel Bill 20 Per Cent	57
Grand Trunk Makes Own Frosted Glass	70
Coupler Jaw Press	70

QUESTIONS & ANSWERS:

Diesel-Electric Locomotives	71
Schedule 24RL Air Brakes	72

ELECTRICAL SECTION:

The Northern Pacific's South Tacoma Electric Shop	74
Wedge Puller for Pinions	79
Some Simple Battery Circuits	80
Work Stands for Large Axle Generators	86
Consulting Department	87

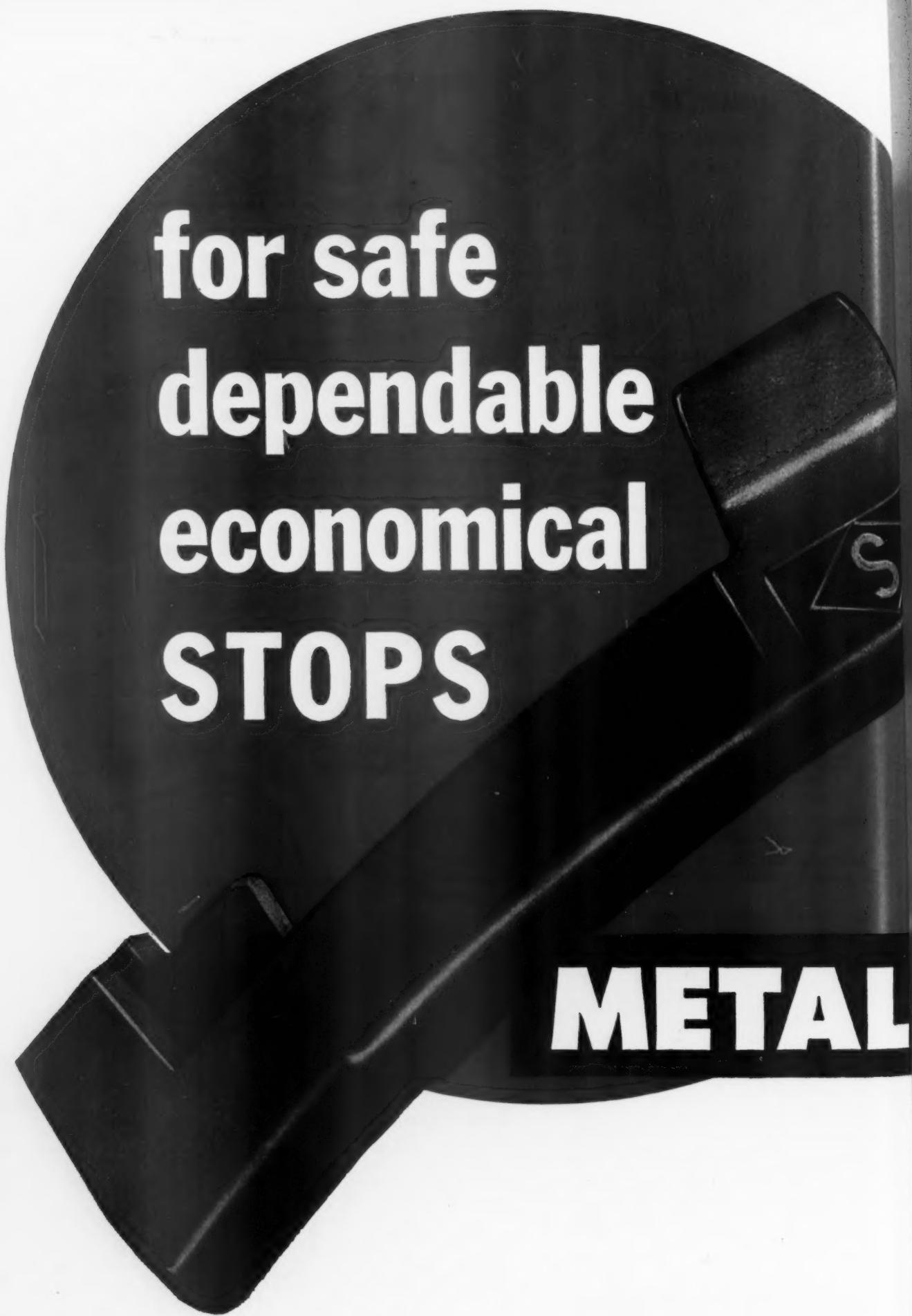
NEW DEVICES:

Semi-Portable Degreaser	88	Heavy-Duty Plain Grinder	92
300-Watt Sealed Beam Floodlamp	88	Selenium Rectifiers	92
Parts Storage Rotary Stand	88	Midget X-Ray Machine	94
400-Cycle Generator	88	Lighting Cluster	94
Shallow Surface Luminaires	91	Steam Gage Illuminator	94
Four Unit Variable Speed	91	Brush for Diesel-Electric Traction	94
Class B Insulation	91	Motors	94
High Strength Copper Base Alloy	91	Load Tester for Diesel Locomotives	121
Solenoid Valves	91	Copper-Clad Steel	121
Chrome-Plated Micrometer	92	Two Spindle Drilling Machine	121
Explosion-Proof Motors	92	Safety Switches	121

NEWS 96

EDITOR'S DESK 46

INDEX TO ADVERTISERS 124



for safe
dependable
economical
STOPS

METAL

Universal

Railroad Electrification?

The number of new types of motive power now being tried out by the railroads is reminiscent of the time when every S.M.P. had his own idea of what a steam locomotive ought to be.

During the past year, six completely new diesel locomotives have been offered by the manufacturers. One is a 1,600-hp. unit having high tractive force at low speed, suitable for main-line freight and hump-yard switching service. It can be equipped with dynamic braking using all six motors. Another is an 800-hp. switcher with dynamic braking. A third is a six-motor locomotive with an axle loading of 360,000 lb., equipped with a new type of truck for good riding qualities at any speed. A fourth is a military road switcher designed to meet world wide clearance limitations, and equipped with six motors and dynamic brakes. A fifth is a booster unit for a 1,600-hp. all-service locomotive. A sixth is a 2,400-hp. hood-type, six-motor, all-service locomotive also equipped with dynamic braking.

Then there are two gas-turbine locomotives. One of these, which has just completed a long series of road tests derives its power from two, 2,000-hp. turbine-driven generators. It produces train heating from the exhaust heat of one of its power plants and has an unusual arrangement of sliding bolster trucks which have performed very well in practice. The first gas turbine locomotive developed in this country was placed in service in 1949. The experimental unit, with a single power plant rated at 4,500-hp. and developing 5,400 hp. in practice, successfully concluded its road tests and now, six service locomotives designed from the experience gained with the experimental model are turning in a good performance record operated by regular train crews without special supervision.

Within a short time, a steam turbine-electric locomotive will make its appearance in railroad service. Rated at 4,500 hp., it is designed around experience obtained in practice with similar locomotives. A primary difference will be its 600-lb., 900-deg., water-tube boiler.

In all this development, straight electric locomotives have not been neglected. One builder produced a series a.c. locomotive capable of operating at much lower speeds than its prototypes which preceded it. Another builder produced a rectifier type locomotive, taking high-voltage a.c. power from the contact system and using it in standard d.c. diesel traction motors. This design has received approval in the form of orders for ten such locomotives and 100 multiple-unit cars of the same type.

Some electrical engineers are now saying that serious attention should be given to electric traction in which the commercial frequency of 60 cycles would be applied

to the contact system, supplying power to electric locomotives using d.c. motors which are relatively low in cost because they are in production in large quantity.

Opinions concerning the various locomotives vary widely. Straight electric locomotives can unquestionably produce the maximum in performance because they can, for short periods, draw large amounts of power from the contact system. Also, they are simple and their maintenance costs are low. The big hurdles they must clear are big first investment for fixed equipment and the fact that they cannot run out from under the overhead wire.

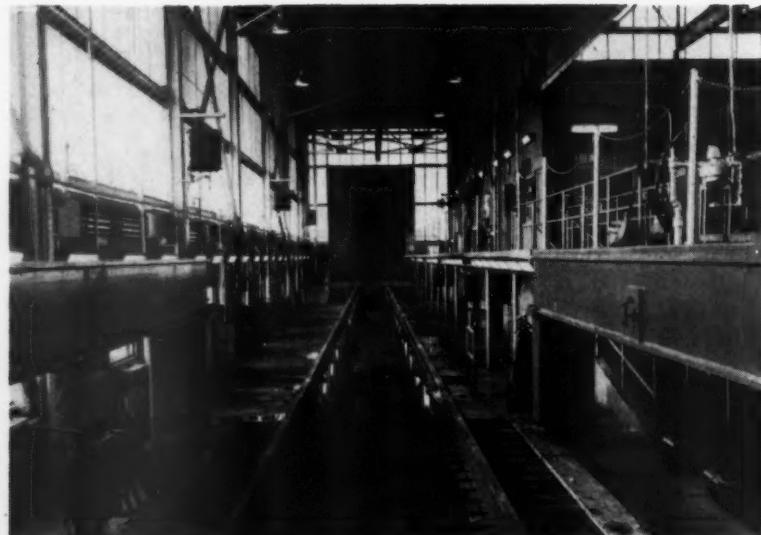
In comparing gas-turbine and diesel locomotives, some engineers point to their respective thermal efficiencies. The diesel starts its gas-expansion cycle at about 4,000 deg. F. and the locomotive gas turbine at perhaps 1,500 deg. F. It means that the diesel has about twice the thermal efficiency, but the gas turbine is doing well right now because it is able to get suitable fuel without objectional contamination at about half the cost of diesel fuel. Such fuel is not easily available at many places, but it seems almost certain, in light of our research history, that future metallurgical developments will permit turbine operation to be extended to higher temperatures with correspondingly higher efficiencies.

At present, it would seem that straight electrification would have to wait until the price of fuel oil has risen to a point which will increase its economic advantage over the diesel. This means that the relative price of oil and the strategic position of the electric locomotive could be equally improved by a reduction in the relative price of coal. Almost certainly, the price of oil will increase. In view of our large coal resources, it would appear that if coal prices rise as rapidly as oil, it will be largely an arbitrary increase.

All of the locomotives under construction and development have one thing in common. They are all electric locomotives with or without their own prime mover. It amounts to electrification of the railroads which has taken place at a rate never dreamed of by the early proponents of electric traction. It has disrupted long-established procedures for locomotive utilization and locomotive maintenance. It has even been resisted by the railroad operators, but it has benefitted the railroads enormously and has served to give them a new lease on life. And only a part of the potentials of the electrification have been realized. Performance can be further improved to continue the railroads as the backbone of American transportation. The greatest needs at the moment are concerned with personnel, employee training and the development of practices appropriate to the new tools in the hands of the railroads.



Above: The parts repair and cleaning room area in the foreground; the supply ramp on the left. Right: Interior of the shop prior to completing the installation of the drop pit, with a locomotive on the stub-track visible at the right.



THE C. & O. DIESEL SHOP AT HUNTINGTON...

THE Chesapeake & Ohio has built a new diesel shop at Huntington, W. Va. for maintaining 24 passenger units and 14 switchers. The building has overall dimensions approximately 185 ft. by 50 ft., with the major dimension running east and west. It houses two tracks, a tool and supply room, a parts reconditioning room, a cleaning room, two 12,500-gal. lube oil storage tanks and toilet and locker facilities. Exhaust fumes are carried out of the building by six 36-in. ventilator fans over the through track and three over the stub track.

One of the two tracks extends through the building while the other terminates at a wall beyond which are the cleaning, reconditioning and supply rooms. A 23½-ft. drop table for handling six-wheel trucks is located near the west end of the building and services both the through and the stub track, with a release track outdoors. The

through track can accommodate two passenger units beyond the drop table. The stub track has an overall length inside the building of 82 ft., and thus can comfortably accommodate a single passenger unit.

A single platform at locomotive floor level runs lengthwise down the center of the shop and provides access to units on either track as well as to the rooms beyond the stub track. Passage between the shop floor and the pit of the through track is facilitated by two sets of steps at two locations along the inside edge of the track.

A ramp on the outside of the building leads directly into the tool and supply room for handling materials in and out of the building. Direct access between this room and the reconditioning and cleaning rooms is provided by openings in the wall.

The rooms for storing, cleaning and repairing parts

are located at the elevation of the locomotive floor level platforms, while the area below these rooms is devoted to locker room and washing facilities for the employees, and to lube oil storage and pumping facilities.

Six piping systems serve the shop—cold water, hot water, treated water, lube oil supply, lube oil return and compressed air. Hot and cold water are piped under the platform (1-in. lines), to the locker rooms ($\frac{3}{4}$ -in. and 1-in. lines), and to the cleaning room ($\frac{3}{4}$ -in. lines). Treated water is supplied to four outlets along the north wall and to two along the south wall.

Shop air is supplied to these two walls to the same number of outlets on each through a $1\frac{1}{4}$ -in. line below the floor. Shop air is also piped to one outlet in the reconditioning room and to two in the cleaning room, as well as to a line under the locomotive-floor-level platform and to one line along most of the lengths of the two shop tracks, with outlets at convenient intervals.

Lube oil is piped to hose reels with nozzles for delivery to the engine through a 3-in. supply line on the under side of the floor level platforms. Drained lube oil is returned to the oil room through 2-in. lines fastened to the side of one rail on each of the service tracks.

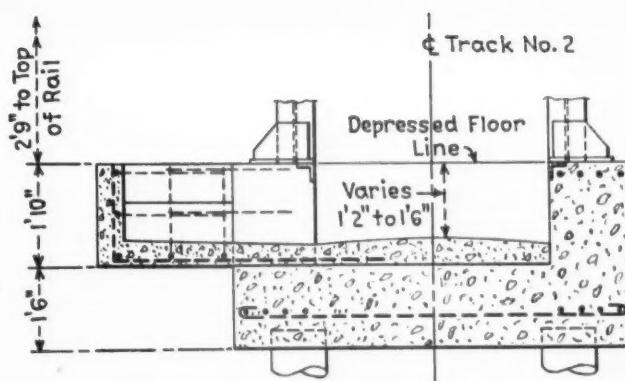
Classes of Work Handled

The diesel shop operates primarily for servicing and preventive maintenance work; heavy repair work can be done only in conjunction with the steam locomotive back shop at Huntington. If a truck requires overhaul, for example, it is removed on the drop pit in the diesel shop and sent to the steam shop on a track which connects the two. While repairs to defective truck are being made, one of two spare trucks kept at Huntington is substituted to continue the locomotive in service.

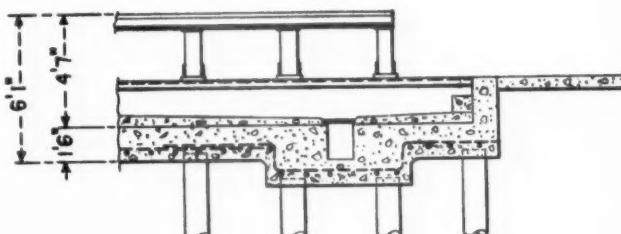
Again, if wheels require turning or renewal on a passenger locomotive truck, the whole truck is dropped and one of the two spare trucks substituted. The truck with the defective wheels is then sent to the steam shop where the wheels are dropped and any necessary work performed. The steam shop has facilities for turning wheels and for boring and applying a new pair. Truck work can be done complete in the steam shop, and all such work is done there whenever the trucks come off the locomotive.

Light to moderate running repairs only are performed on the engine and electrical equipment. The same general arrangement applies to these equipments as to trucks. Minor adjustments, cleaning and repair work done to the parts in place is handled by the diesel shop. Major repairs are done in the steam shop, the role of the diesel shop being limited to the removal of the defective part and its re-application after overhaul. The diesel shop, for example, pulls liners for boring and honing in the steam shop, substituting spares which are kept on hand to return the locomotives to service.

Electrical work done falls primarily in the category of preventive maintenance. No heavy electrical work has been required as yet on the locomotives, and it is expected that any that becomes necessary can be handled in the steam shop. The back shop electrical repair room is currently being set up to do some heavy work on diesel-electric equipment. Parts that come off the locomotive at annual inspections are sent to the steam shop for overhaul. Running repair work, such as tightening loose connections, changing brushes, etc., up to commutator stoning, is done in the diesel shop.



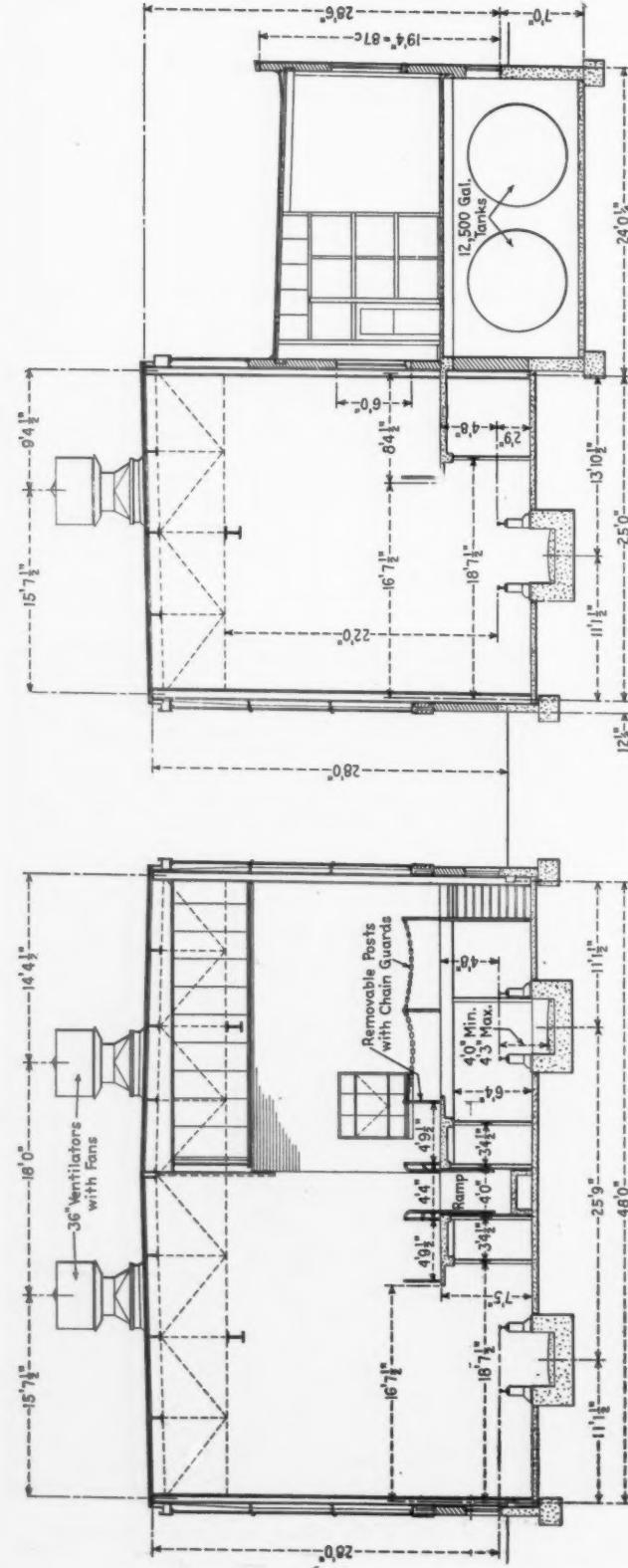
A cross-section through elevated track and pit.



Longitudinal section through elevated track and pit.



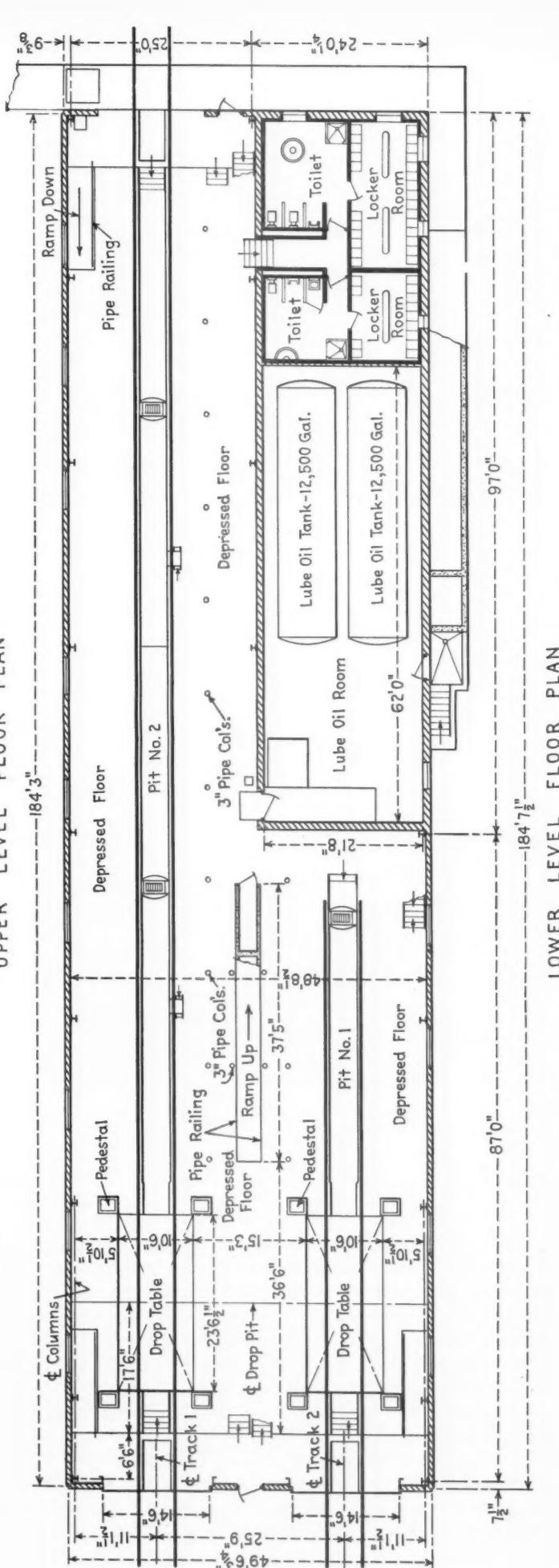
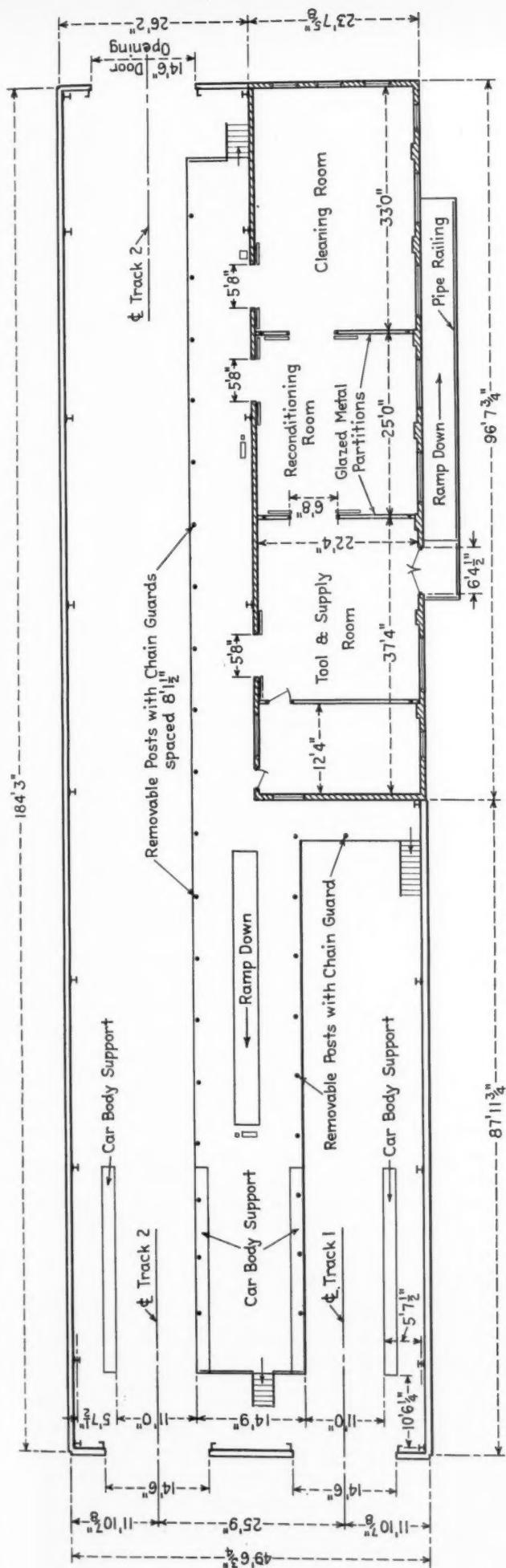
Easy entrance to the pits of the through track is afforded by sets of steps and recesses.



Typical cross sections of the Chesapeake & Ohio diesel repair shop through the working space and through the lube oil storage room.

THE C. & O. HUNTINGTON DIESEL SHOP

DIESEL PASSENGER POOL
IN THE SCHEDULE OF THE LOCOMOTIVE





General view of the fueling, cleaning and sanding facilities from the shop side showing the platforms for entrance to the locomotive cab.



The fueling, sanding and cleaning facilities with the entrance to the through and to the stub track in the background.



One of the passenger units being cleaned on the well drained and well lighted washing facilities.

The Passenger Pool Cycle

The Chesapeake & Ohio diesel passenger pool comprises a total of 24 units, of which 22 are combined to form 11 two-unit locomotives to handle main line name trains. One unit handles a local train on a 147-mile run from Huntington to Hinton, W. Va., leaving Huntington at 1:10 p.m., arriving Hinton at 6:30 p.m., returning from Hinton at 8:05 p.m. for a 1:15 a.m. arrival at Huntington. The remaining unit is a spare. It can be combined with the local-train unit to form a two-unit locomotive to substitute for any of the 11 regular locomotives.

Each day one of the eleven locomotives begins the cycle shown in the table, which was devised to obtain maximum mileage consistent with assigning diesel power to all principal passenger trains on the several main line runs of the C. & O., as well as to make sufficient time available for

the necessary inspection, servicing and maintenance work.

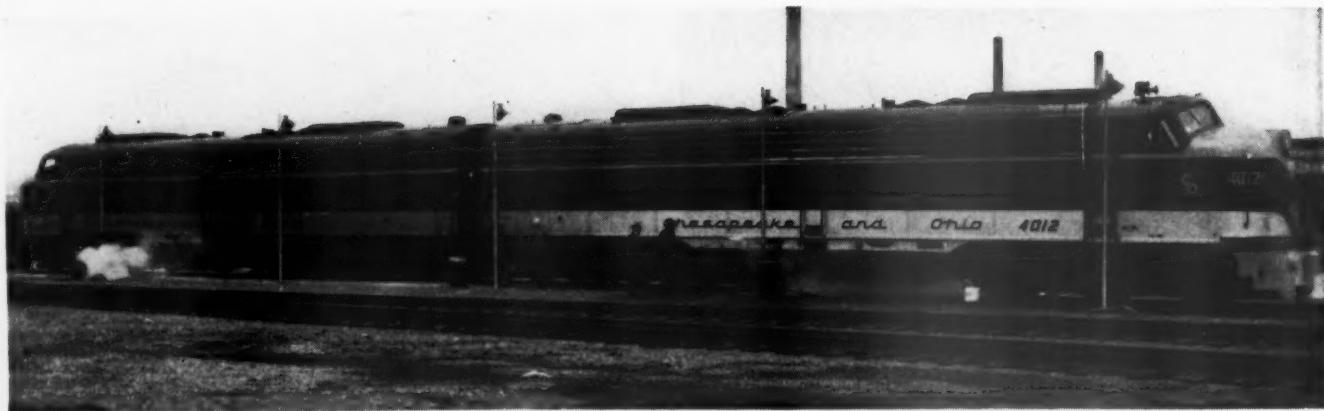
The units are combined in such a way to obtain two objectives which can be seen from the bottom six lines. First, each unit of the pair which combined to form each locomotive has a total mileage approximately that of the companion unit. Second, the total amount of work to be done at the completion of each 11-day cycle is as nearly equal as possible between the different locomotives.

The monthly I.C.C. inspection is due on only one of each pair of units at the completion of each cycle. Preventive maintenance due at the various mileages (5,000, 10,000, 20,000) are staggered to the extent possible so that when a considerable amount of work is due on one unit of a given pair, the second unit will require only a small amount of work.

This passenger cycle works out nicely to give high locomotive mileage with reasonable intervals for the necessary inspection, servicing and repair. It does, of course, have the one disadvantage bound to occur with an 11-day cycle, and that is that the I.C.C. inspection must be given every 22 days, or every other cycle, because three cycles require 33 days. This disadvantage is more than compensated for by the fact that the system makes possible a high usage factor. The average daily mileage per locomotive is 482.5, a good figure for an entire fleet of over the network of assignments which include substantial distances over terrain not suited to high-speed operation.

Switchers Also Rotated

The Huntington diesel shops maintain a total of fourteen 1,000-h.p. switching locomotives, of which seven are stationed at Huntington, five at Charleston, W. Va. (51 miles east of Huntington) and two at Handley, W. Va., just beyond Charleston. The switchers stationed at Charleston and Handley receive periodic inspections other than annuals where they are stationed. For annuals or any unusually heavy work, these locomotives are brought to Huntington. Work found necessary at periodic inspections up to liner pulling, wheel changeout or commutator stoning is done at these two points.



One of the two-unit passenger locomotives used on main-line name trains in the process of being cleaned

When a diesel switcher from Handley or Charleston requires work at the Huntington shop, that switcher is replaced immediately by one of the seven diesels assigned to Huntington, and a steam switcher takes over one of the Huntington assignments. The substitution of the Huntington locomotive for the Charleston or Handley switcher, as the case may be, is made without delay to switching work. The switcher works a local train to Handley or Charleston, (an assignment regularly rotated among the seven Huntington diesels) doing local switching between the two points as well as at the eastern terminal before its return run. The only departure from regular practice is, therefore, to trade off at Handley or Charleston, the Huntington switcher for the locomotive which requires work to be done at Huntington.

The local freight handled by the Huntington switcher leaves Huntington at 8:00 a.m. on Mondays, Wednesdays and Fridays. It reaches Handley, 74 miles distant, at 2:00 p.m., where it is used for yard work until 6:00 a.m. the next day. Westbound departures of the local from Handley are at 8:00 a.m. Tuesdays, Thursdays and Saturdays, arriving at Huntington 2:30 p.m. for yard service until eight the next morning.

When the defective locomotive to be traded for the Huntington switcher is at Charleston, the Huntington

locomotive drops off at Charleston on the way to Handley. The locomotive to be repaired at Huntington then takes the train from Charleston to Handley returning straight through to Huntington on the local freight. The switch is made on the eastbound trip to have the locomotive headed in the most advantageous way for both the road trip and the local switching.

Lubricating Oil Practices

Lubricating oil on both passenger units and switchers is changed as determined by test results, with a 60,000-mile limit on passenger locomotives and a one-year limit on switchers.

Samples are taken for a complete physical test every 11 days on the passenger units, every 30 days on switchers. In addition, viscosity gage readings are taken on passenger diesels at outlying points during each 11-day cycle. If there is a substantial variation between the viscosity gage readings, a sample of the oil is sent to Huntington for complete analysis.

The regular sample taken for the complete physical test is taken on the 10th day of the cycle at Huntington during a 3½-hr. layover so that results will be available when the locomotive comes in for its major trip maintenance.

Table Speeds Up Sorting of Small Parts

The Louisville & Nashville has developed a neat solution to the problem of sorting small parts in the pickings off the floor in the South Louisville heavy car repair shops. Bolts, nuts, washers, keys, rivets and cotter keys are separated and assembled into usable homogenous groups on a special sorting table.

The principal of the table is simple. Sweepings from the floor containing usable items are shoveled into a hopper which discharges its contents to the top of the table. The quantity of the mixed parts to be discharged is controlled by a small sliding door at the bottom of the bin. Parts on the table top are then sorted into any number of groups up to seven by sliding each part

(bolt, rivet, cotter key, etc.) over to one of seven holes in the table. Each hole leads to a chute which drops the part into an individual metal box which is located under the table.

The hopper into which the parts are shoveled is approximately 16 in. by 18 in. cross section, and it extends to a height 31 in. above the top of the table. The height of the table top itself is adjustable between 31 in. and 40 in. in three steps by means of telescoping table legs. The outside tubing of each telescoping leg is a little over 2 in. in inside diameter, the inside tubing a little under 2 in. in outside diameter.

The table top is made of $\frac{1}{4}$ -in. plate, the bottom of the hopper chute of $\frac{3}{16}$ -in. material, and the remainder of the table of $\frac{1}{8}$ -in. steel.

The two openings in the rear corners of the table top are irregularly shaped with maximum dimensions roughly $4\frac{1}{4}$ in. by $9\frac{1}{2}$ in. The five circular openings are all $4\frac{1}{4}$ in.

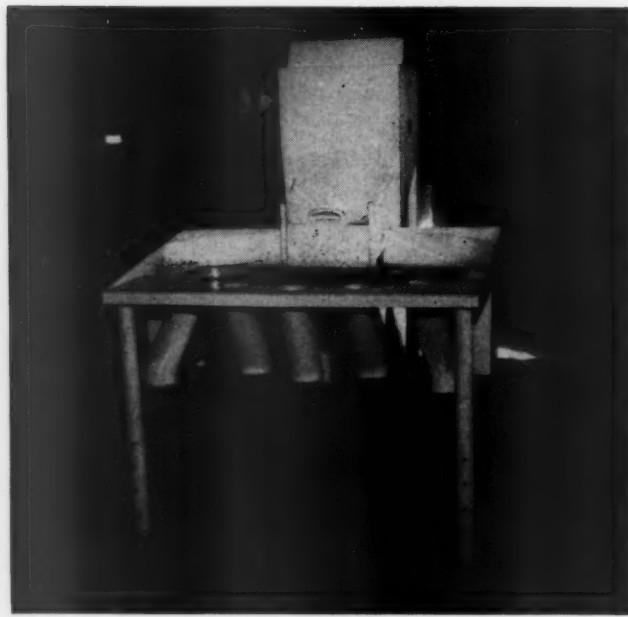
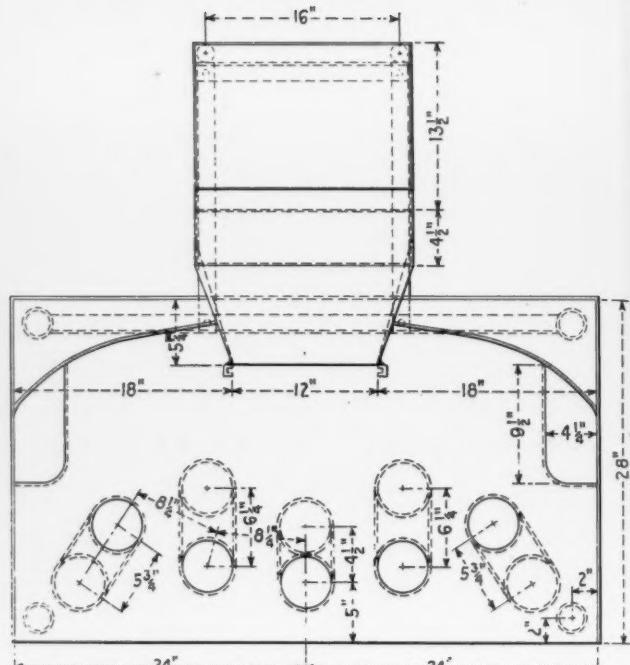


Table to sort up to seven items at a time into the boxes on the floor

in diameter. These lead to spouts which are set at an angle with the vertical of roughly 30 deg. and extend to a distance 12 in. below the table. They are set at the 30 deg. angle so that a maximum number of square boxes can be placed under the table as shown in the illustration



Top view of the table.

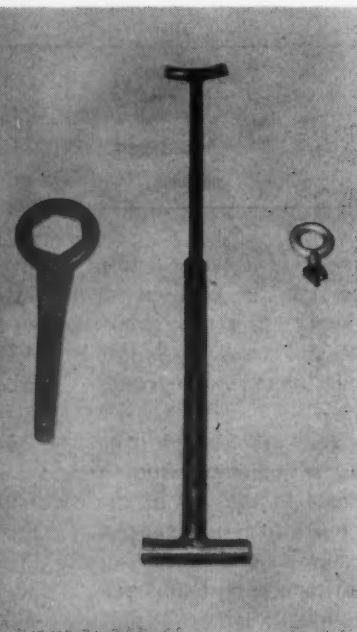
for collecting the various items. The vertically sliding door through which the hopper discharges parts to the table top is 6 in. by 12.

Holds Fork Rod While Pulling Blade Rod

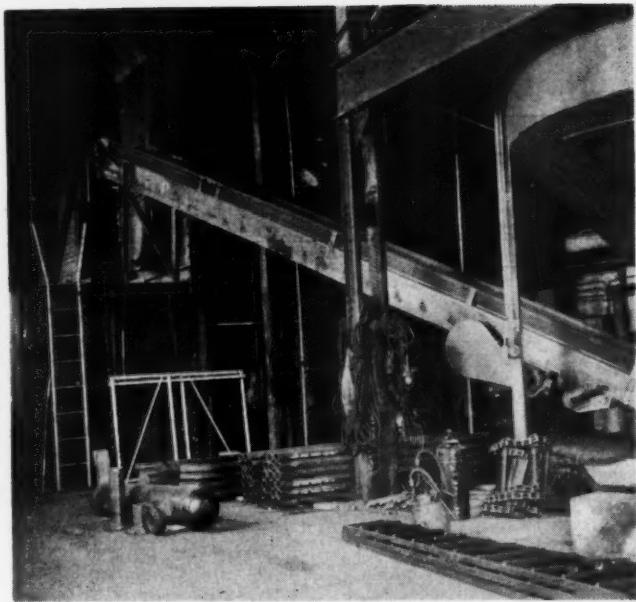
A jack developed at the shops of a southeastern road holds the fork rod when the blade rod only is to be pulled. The jack has a shaft 26 1/2 in. long which

fits in a tube 24 in. long made of 3/4-in. electrical conduit. The jack is locked in position by mating holes in the shaft and tubing.

To pull the blade rod, the bottom of the tube is set in the oil pan, the engine barred over 20 deg., and the rod slid out until it contacts the wrist pin. When the engine is barred back the weight of the piston holds the jack in place; the jack in turn holds fork rod in place.



The fork rod, when the blade rod only is to be pulled, is held in place with a jack, the parts of which are shown at the right.



Shavings collected from the wood mill and cabinet shop are delivered from the hopper to this conveyor belt to fire the power-plant boiler.



The boiler is fired by oil until this hopper is filled, at which time the switch is made to burning the shavings until the hopper is empty.

Burning Wood Shavings Cuts Fuel Bill 20 Per Cent

The Grand Trunk Western Shops at Port Huron, Mich., are laid out with a cabinet shop on one side of the power plant and a woodmill on the other side, both located about 50 feet from the power house. This layout has made it relatively inexpensive to install equipment for burning shavings and other scrap wood in the power plant.

The installation of the equipment for the collection and disposal of sawdust has accomplished two useful objectives at one time. It has reduced the power plant fuel cost, and has eliminated the nuisance of collecting and otherwise disposing of shavings.

The wood shavings are picked up by a vacuum provided by a "cyclone" through piping installed in the mill and in the cabinet shop. The shavings are delivered to the power house storage tank by means of air pressure through overhead pipe lines from the mill and cabinet shop. The fan which picks up the shavings and delivers them to the power house is driven by a 100-hp. electric motor.

The power plant boiler is designed with a dutch oven for burning sawdust and scrap wood in a pile. The opposite end of the boiler is equipped with oil burners which may be used when shavings and scrap wood are not available. The normal procedure in firing this particular boiler is to use scrap wood and shavings. However, the boiler may also be fired by oil. The design of the boiler is such that it is not advisable to burn both wood and oil at the same time.

When firing the boiler with wood shavings they are fed by means of a motor-driven belt-conveyor from the storage tank to a hopper located directly above the dutch oven. The shavings from this hopper are fed by gravity into a fire box.



Shavings are picked up from the wood mill and the cabinet shop and delivered to the power plant by this 100-hp. cyclone.

To permit disposal of larger pieces of scrap wood a "hogger" will be installed in the power house. The hogger will be driven by a 75-hp. motor and will have a capacity of reducing to shavings, scrap wood up to the equivalent of 4-inch square oak, 16 feet long.

It has been estimated that a 20 per cent saving on power plant fuel can be made with this installation.

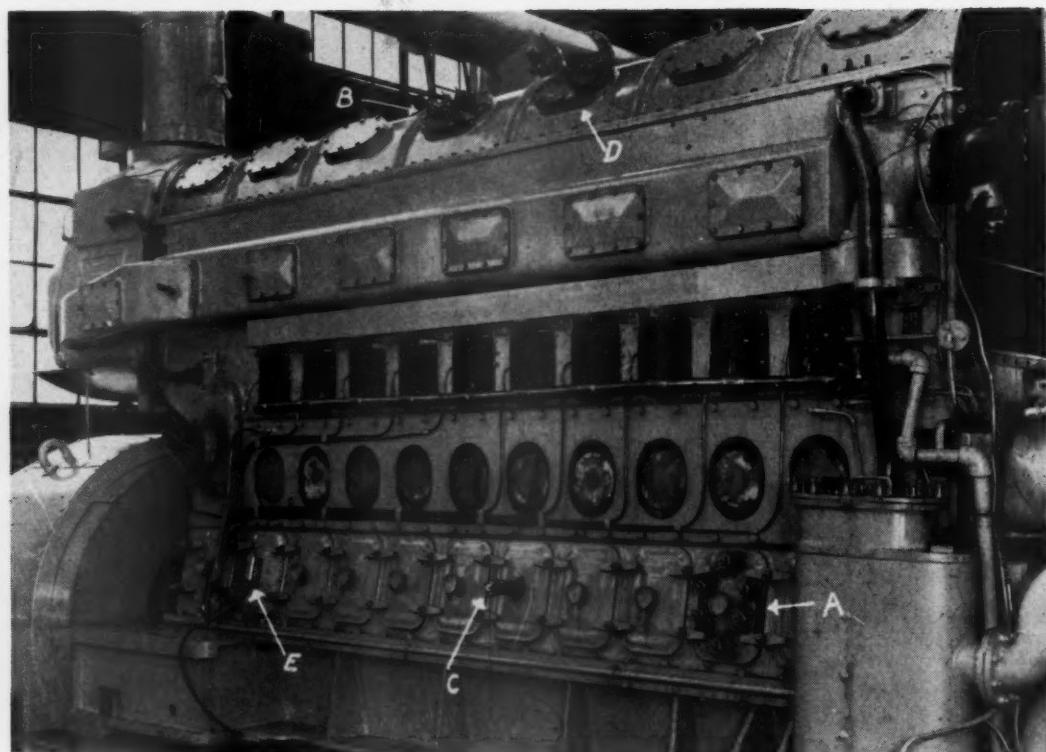


Fig. 1—Crankcase explosion test engine with calorific element and pressure pick-up equipment installed.

CRANKCASE EXPLOSIONS...

In view of the large number of diesel engines in use, the percentage of crankcase explosions is extremely small, but the greatly expanded use and application of diesel power has created an increase in the total number of these mishaps, which causes considerable concern. According to a report by R. O. Montenero, Fairbanks, Morse & Co., at the recent annual meeting of the American Society of Mechanical Engineers Oil and Gas Power Division in New York, many of these explosions have been minor. However, there are a few that have made prominent headlines due to the serious damage that occurred. Although this publicity tends to exaggerate the danger, it is nevertheless important to discover methods of further reducing the risk.

Published literature and discussions on crankcase explosions generally agree that the crankcase atmosphere in a normally operating Diesel engine is primarily composed of lube oil droplets or mist suspended in air by the action of revolving or reciprocating parts. The danger of explosion is introduced when the heat generated locally from some mechanical derangement vaporizes sufficient quantities of oil particles to form an explosive mixture, and subsequently, furnishes the additional heat necessary for ignition. However, the presence of these essential conditions does not ensure that a violent crankcase explosion will occur. Circumstances involved in actual

explosions have convinced most observers that a sealed crankcase mixture is too rich for a severe explosion. The damaging explosions and fires occurred after a cover had been removed either by the pressure from a preliminary mild explosion, or by an operator inclined to investigate some mechanical malfunction immediately after shutting down an engine. This removal of a cover permitted an additional amount of air to enter the crankcase, thus sufficiently leaning the mixture to make it highly combustible, and caused a more severe second explosion.

Six Methods Tried

Although no method has as yet been found to completely eliminate the possibility of these explosions; various measures have been adopted which have definitely reduced their frequency. Other measures have been adopted which successfully limit the damage from fire and pressure when an explosion does occur. These include:

1. Improved design and materials to reduce all conditions contributing to "hot spots". Reasonable doubt exists as to whether these conditions can be completely eliminated. Failure of parts may occur in any engine design, therefore potential ignitors cannot be entirely avoided.
2. Emphasize good maintenance and provide personnel

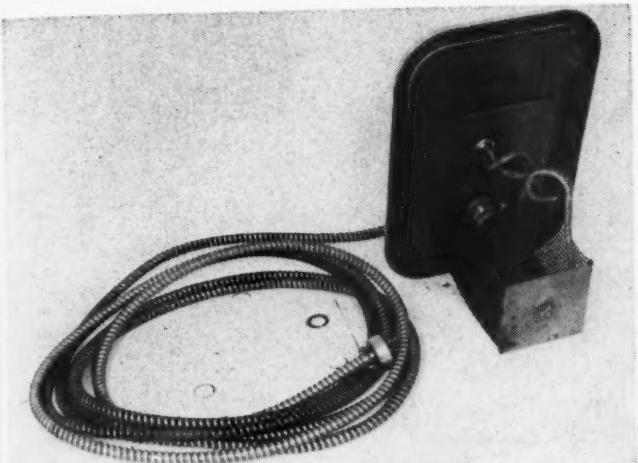


Fig. 2—Details of the lower crankcase cover with caloric insert.

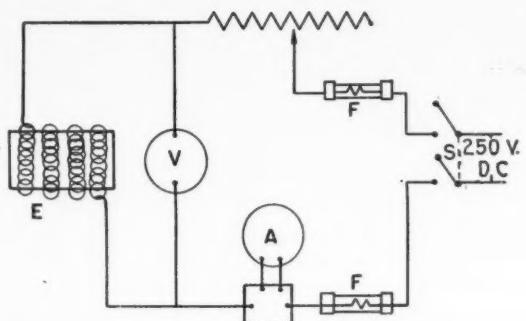


Fig. 3—How nichrome element *E* is energized by 250-volt d.c. power source with variable resistance.

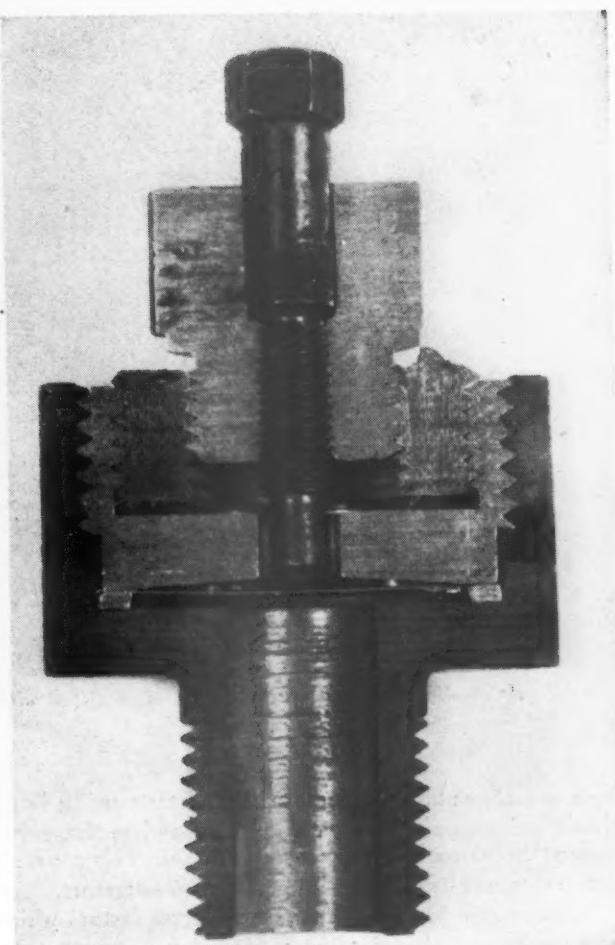


Fig. 4—Cross-section of diaphragm type pressure pick-up.

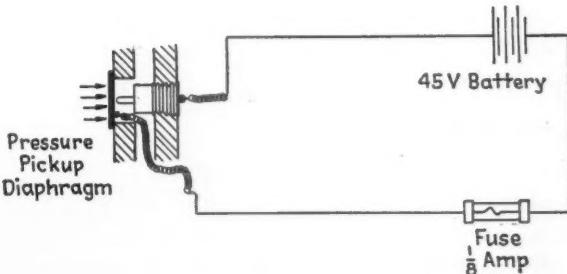


Fig. 5—Diagram of pressure pick-up unit and electric fuse circuit.

with adequate instructions in order that the engine will not be operated with excessively worn, broken, or improperly assembled parts.

3. Provide a sufficient quantity of lightweight relief valves to relieve the pressure of the initial explosion and prevent the disastrous inrush of fresh air.

4. Thoroughly ventilate crankcases so that the vapor mixture will always be too lean to ignite. Here the difficulty arises because the ventilation must be thorough. This necessarily requires large inlets into the crankcase and the inlets must be correctly located to avoid unventilated pockets behind stress members and would-be baffles due to crankcase construction. Proper air filtration is necessary to keep contaminants out of the lubricating oil. Oil leakage and the need for proper oil separators present added problems.

5. Another preventative method is the use of engine shut-down devices that are actuated by a pressure rise in crankcase. This method stops the engine in order to prevent further overheating of the source of ignition.

6. Strengthen the crankcase to withstand the force of an explosion. This can be considered for new engines and old engines where only the redesign of covers is necessary. It is questionable whether it is economically practicable to follow this design on very large slow speed engines where large surface areas are exposed to the

pressure and also where crankcase doors would be too heavy to handle.

Since no practical means have been developed to completely eliminate the origin of crankcase explosions, the efforts of Fairbanks, Morse & Co., in addition to improving designs and materials, were directed to containing the explosions and thereby eliminating the external damage sometimes accompanying these accidents. A study of possible pressures that could be attained in a crankcase indicates that an engine designed to contain approximately 100 psi pressure without rupture would withstand the explosion.

Calculations of a theoretically complete combustion of an optimum fuel-air mixture may indicate that slightly higher pressures could exist. However, evidence gathered

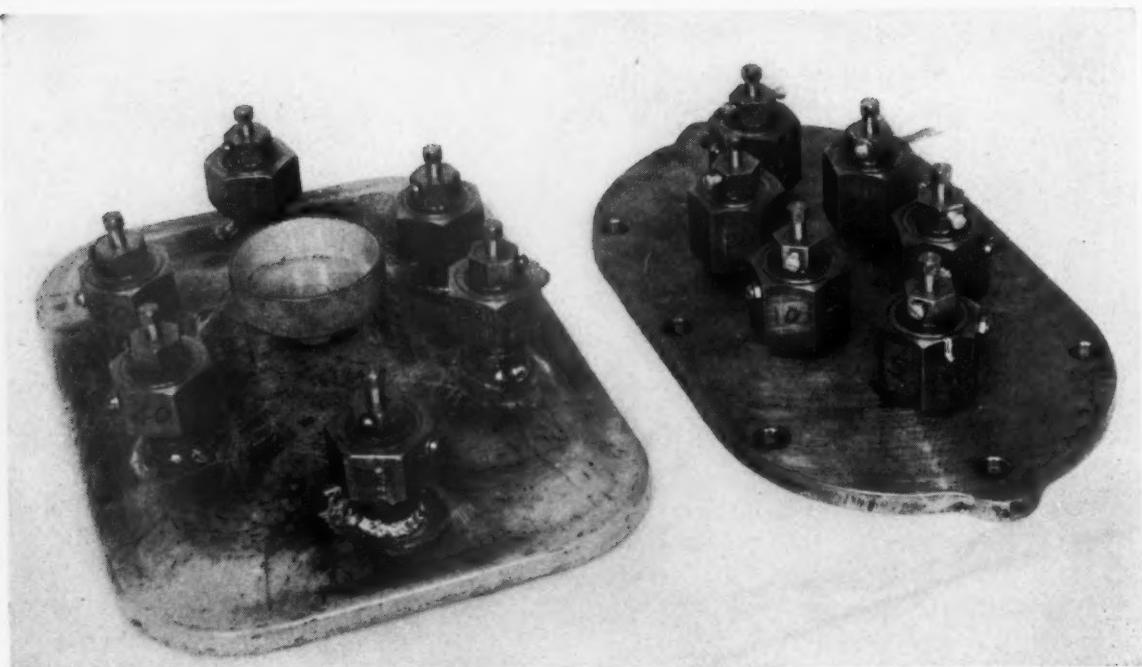


Fig. 6—Upper and lower crankcase covers equipped with cluster of pressure pick-ups.

from actual explosions in experimental tests using large closed volumes charged with propane and methane has shown that pressures do not exceed 100 psi. This approximate value has been reported by other investigators.

In an engine crankcase there are several factors which tend to reduce the maximum explosion pressure to a value lower than the approximately 100 psi obtained in experiments using methane or propane gas. An example is that lube oil is a heavier hydrocarbon having a corresponding lower heating value per pound than propane or methane. Also, an engine crankcase has more surface area per unit volume than the test bombs, thus providing better heat dissipation.

Engine Details Strengthened

Taking all these factors into account, it was considered that the Fairbanks-Morse 8½ in. by 10 in. Opposed Piston locomotive engine was capable of withstanding the pressures encountered in a crankcase explosion provided the crankcase access covers and oil pan subbase were redesigned.

The contour of the top crankcase cover was changed to a semi-cylindrical shape to utilize the hoop strength of this design. The size of the capscrews securing this cover was changed from ¾ in. to ½ in. and the spacing was changed from 6 in. to 3 in.

The forward end cover and flywheel end covers were changed from a pressed steel to a ribbed cast aluminum design to provide added strength, and again the capscrews were increased in size from ¾ in. to ½ in. diameter. All spring loaded pressure relief valves were eliminated. The lower crankcase inspection covers were originally a pressed steel assembly with a clamping arrangement securing them to the block from the inside of the crankcase. These were greatly strengthened by applying 5/8-in. studs to the outside of the block near all four corners of the covers, and securing covers with steel lugs.

The welded steel subbase was reinforced by the addition of internal and external gussets to the sides.

These combined changes for increasing the strength were made in a manner that resulted in negligible additional weight to the complete engine. Digressing from crankcase explosions, it should be pointed out that reinforcing these covers has resulted in a virtually oil-tight engine.

Crankcase Explosions Produced

In order to evaluate the advantages of these design changes with reference to crankcase explosions, preparations were made to produce an explosion in the engine and to observe the resulting pressures.

To our knowledge, none of the experiments of other investigators were conducted by actually producing an explosion in the crankcase of a large locomotive engine operating under load and equipped with special instrumentation to record the results.

The particular engine subjected to these tests was a 10-cylinder, 8½-in. by 10-in. stroke Opposed-Piston, 2-cycle engine used in the Fairbanks-Morse 2,000-hp. locomotives. This engine is equipped with a crankcase breather connected to the blower suction to maintain a vacuum of one to two inches of water in the crankcase. The special instrumentation includes diaphragm pressure-recording pickups *A* and *B* placed in the lower and upper crankcase covers. Crosby-type steam engine indicators are installed at *C* and *D*. The nichrome ignition element *E* is installed in a lower crankcase handhole cover. Another cluster of the diaphragm pressure recording pick-ups is installed in the lower handhole cover directly opposite from the ignition element.

The "hot spot" in the engine was simulated by passing a remotely controlled electric current through a nichrome resistance element located inside the lower crankcase. The details of this heating element are shown in Fig. 2. The element consisted of 16-gage nichrome wire with a resistance of 6.5 ohms and was wound on a ceramic spool.

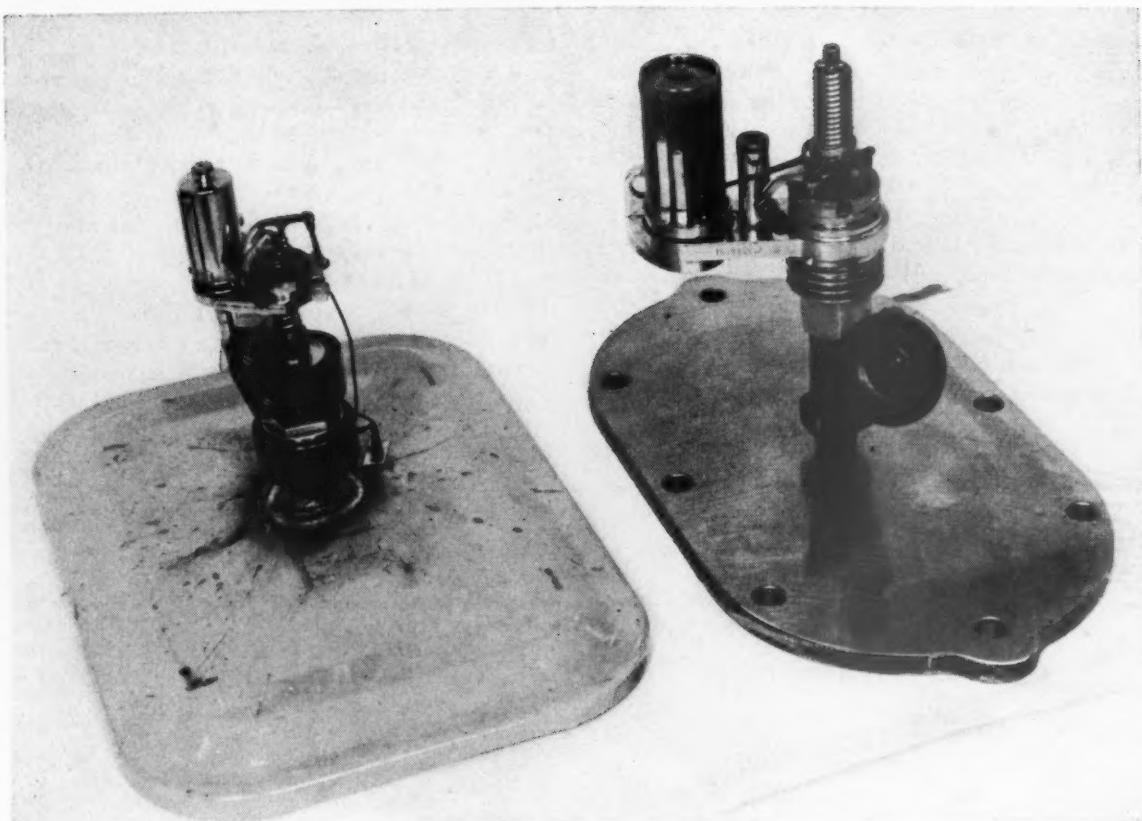


Fig. 7—Crosby type steam engine indicators used to check against diaphragm instrumentation results.

The element was energized by a 250 volt d.c. power source with a variable resistor as shown in Fig. 3.

The diaphragm-type pressure pick-up units have a .005-in. thick steel diaphragm used as a working element which, when deflected by a predetermined calibrated pressure, contacts the center electrode. This contact closes a circuit containing a 45-volt B battery and a $\frac{1}{8}$ amp. fuse in addition to the pressure pick-up. The fuse circuit is shown in Fig. 4. These elements were installed in crankcase covers in groups of six as shown in Fig. 1. In each cluster of six, one element was calibrated for one of the following pressures: 5, 10, 20, 30, 40 and 50 p.s.i. With this arrangement, it was possible to bracket the maximum pressure of the explosion by observing the blown fuses in the individual element pick-up circuits. The type of fuse and battery used in the test is shown in Fig. 5. This type of pressure indicating equipment was selected because of the relatively low inertia forces involved in moving the thin steel diaphragm only a few thousandths of an inch.

In addition to the diaphragm type pick-ups, the engine was equipped with two Crosby type steam engine indicators; one mounted in the upper crankcase cover and the other in the lower cover. These are shown in Fig. 6.

It was recognized that these units are affected by inertia forces, but thought advisable to use them as a check against the diaphragm instrumentation system.

How First Test Was Made

The first test was started by setting the engine load and speed at approximately 50 per cent load and 850 r.p.m. (rated full speed), respectively. After engine conditions were stabilized, the "hot spot" was energized

TABLE SHOWING HOW EXPLOSION PRESSURES WERE CONSISTENTLY HELD BETWEEN 10 LB. AND 20 LB.

TEST NO.	OIL TEMP.	LOAD B.H.P.	PICKUPS	PRESSURES--P.S.I.G DRUM INDICATOR
1	160	1060	10 to 20	19
2	180	1060	10 to 20	
3	200	1060	10 to 20	14
4	215	1340	10 to 20	
5	230	1740	10 to 20	11

and the power input to the nichrome element was increased until the explosion occurred. The input to the nichrome element required for explosion was 5.7 kw.

The only external evidence of the explosion was the oil and smoke that was ejected from around the crankshaft labyrinth seal. After sufficient time had elapsed, the engine was inspected for any evidence of damage, loose covers, capscrews, etc., and it was found that only the water in the crankcase suction manometer had been blown out. Pressures that were recorded showed that the intensity of the explosion had not exceeded 20 p.s.i.g.

In order to determine the effect that the lube oil temperature has on the intensity of the explosion, a series of four test explosions were induced consecutively without an engine shut-down between explosions. For each of these explosions, the power input to the "hot spot" was held constant at 5.7 kw., and although the lube oil temperature was varied from 160 deg. F. to 230 deg. F., all explosions occurred from 13 to 15 sec. after the "hot spot" was energized and pressures were consistently between 10 and 20 p.s.i. Results are shown in the table.

Reviewing this tabulation it is noted that in tests Nos. 4 and 5 the engine horsepower was increased from 1060

to 1340 and 1740 respectively. This was necessary to obtain the higher oil temperatures above 200 deg. F. The only ruptured fuses in the diaphragm type pick-up circuit were those connected to elements set at 5 and 10 p.s.i. The fuses connected to the elements set at 20, 30, 40 and 50 u.s.i. did not rupture in any of tests. In tests Nos. 2 and 4, paper mounted on the drums of the steam engine indicator worked loose and no data were obtained.

During an accelerated test when this particular engine was equipped with special experimental pistons and was being operated at 95.5 b.m.e.p., 850 r.p.m., with 270 deg. F. lube oil temperature, one of the pistons seized and a crankcase explosion occurred, but, all covers remained tight and there was no explosion damage to engine.

Conclusions Drawn from Tests

- With all engine conditions normal except for a "hot

spot" in the crankcase, the peak pressure developed by a primary explosion will not exceed 20 p.s.i.g.

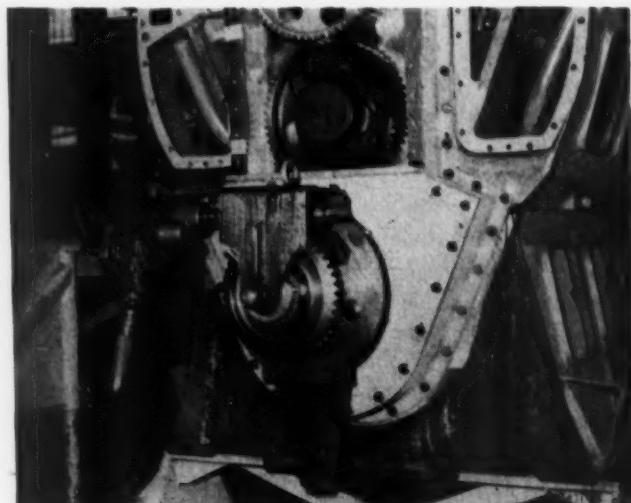
2. Varying the oil temperature from 160 deg. to 230 deg. F. had no important effect on the maximum explosion pressures developed. Also, an explosion with 270 deg. F. lube oil temperature did not result in any explosion damage.

Fairbanks, Morse & Co. has in operation approximately 100 engines which have incorporated this explosion proof design and the oldest have been in railroad service for 2½ years. Even though several of these units have had internal part failures which ignited the crankcase vapors, not one of these 100 units has either blown off a cover or suffered any explosion damage. This combination of service experience and the results of the experimental tests has demonstrated that "crankcase explosions can be contained!"

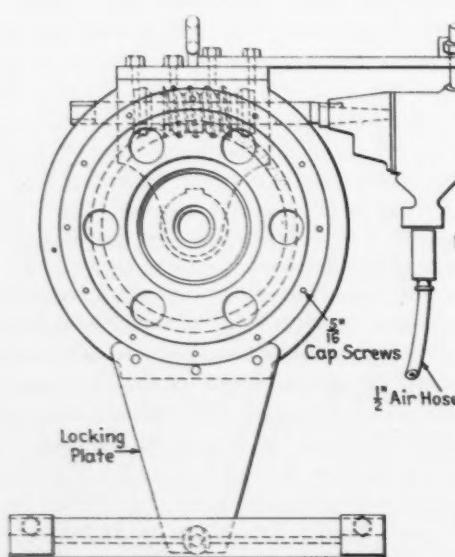
Crankshaft Rotating Device

The crankshaft rotating device, illustrated is used at a large western railroad shop in rebuilding Electro-Motive Class 567 engines. It consists of worm-gear drive from a No. 4 reversible air motor mounted on a driving plate locked to the bottom of the oil pan and arranged for suitable connection to the end of the crankshaft so it can be rotated by power. The old method of turning the crankshaft was unsatisfactory and at times required the labor of two men with a bar.

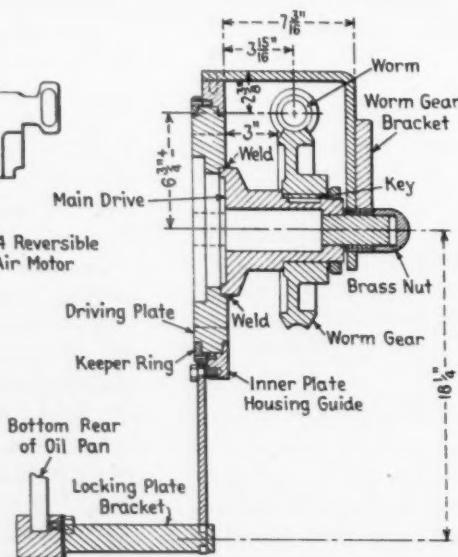
Following are some advantages claimed for this device: (1) It is self-locking because of the worm drive; (2) the reversible motor permits easy turning in either direction; (3) there is an improvement in efficiency; (4) the device can be used in checking the back flush of lube oil; (5) it can be applied in about 9 min.



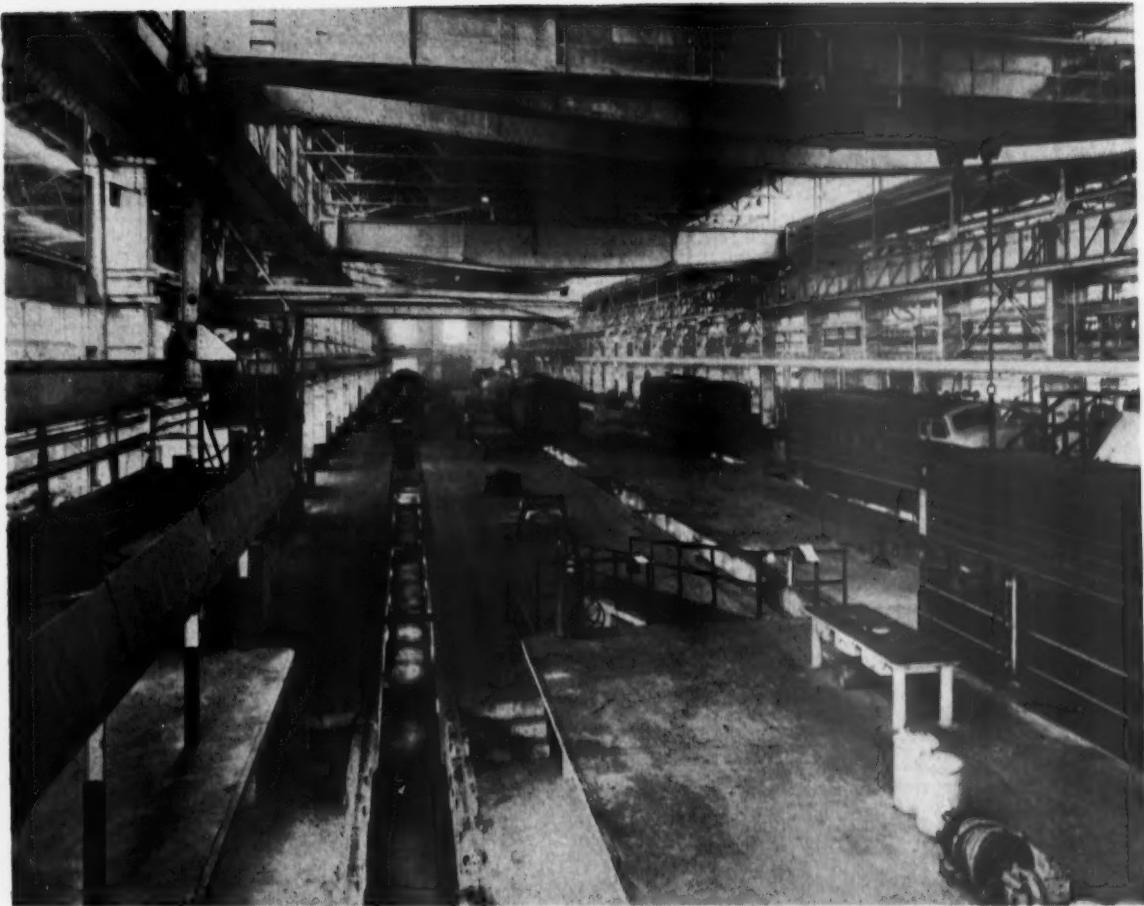
Crankshaft rotating device applied to a Class 567 diesel



FRONT END ASSEMBLY



General arrangement of crank-shaft rotating device for use with E-M Class 567 diesel engines



Erecting bay of the Glenwood shop as seen from the top platform of the three-level working area. Shop has new

reinforced concrete floor. An intercommunication talk-back system with stations throughout shop speeds up operations.

B. & O. CHANGES GLENWOOD SHOP INTO DIESEL REPAIR CENTER

THE Baltimore & Ohio has converted the centrally located Glenwood (Pittsburgh, Pa.) steam back shop into a production center for heavy repairs to all system diesel freight units and also to switchers assigned to the central region. In changing the shop over for diesel work the B. & O. designed the repair facilities to handle the overhaul of major diesel components on a straight-line production basis.

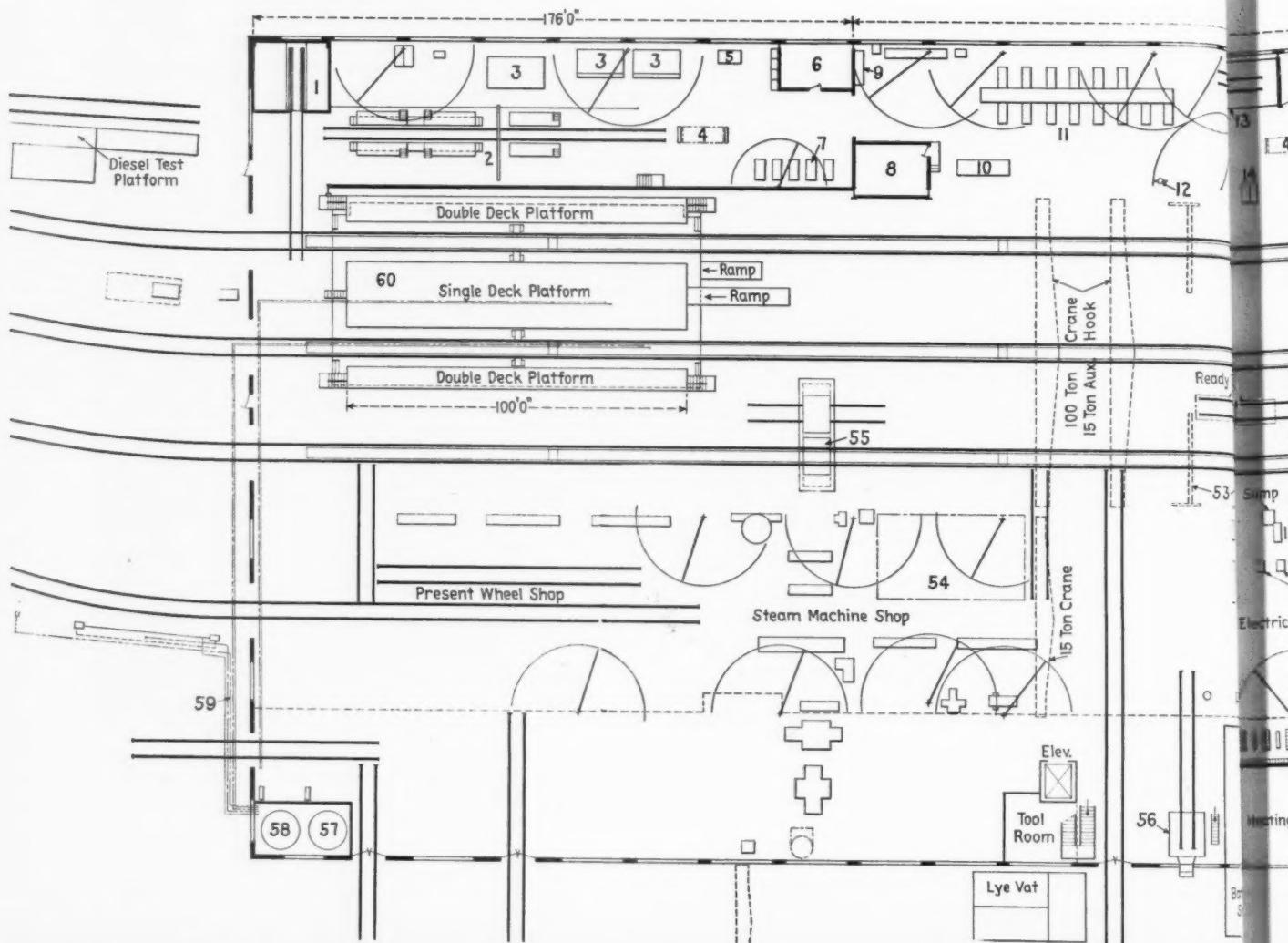
The Glenwood shop is 232 ft. wide and 638 ft. long with three main bays and two narrow bays as shown on the accompanying floor plan. It was equipped originally with two 100-ton overhead cranes in the main erecting bay, a 30-ton crane in the north bay and a 15-ton crane in the main south bay which gave the shop ample crane capacity for diesel repair operations. The construction

changes to the shop included the installation of a new reinforced concrete floor, a three-level working area, new lighting, drop tables, and tools and equipment for engine and electrical repairs.

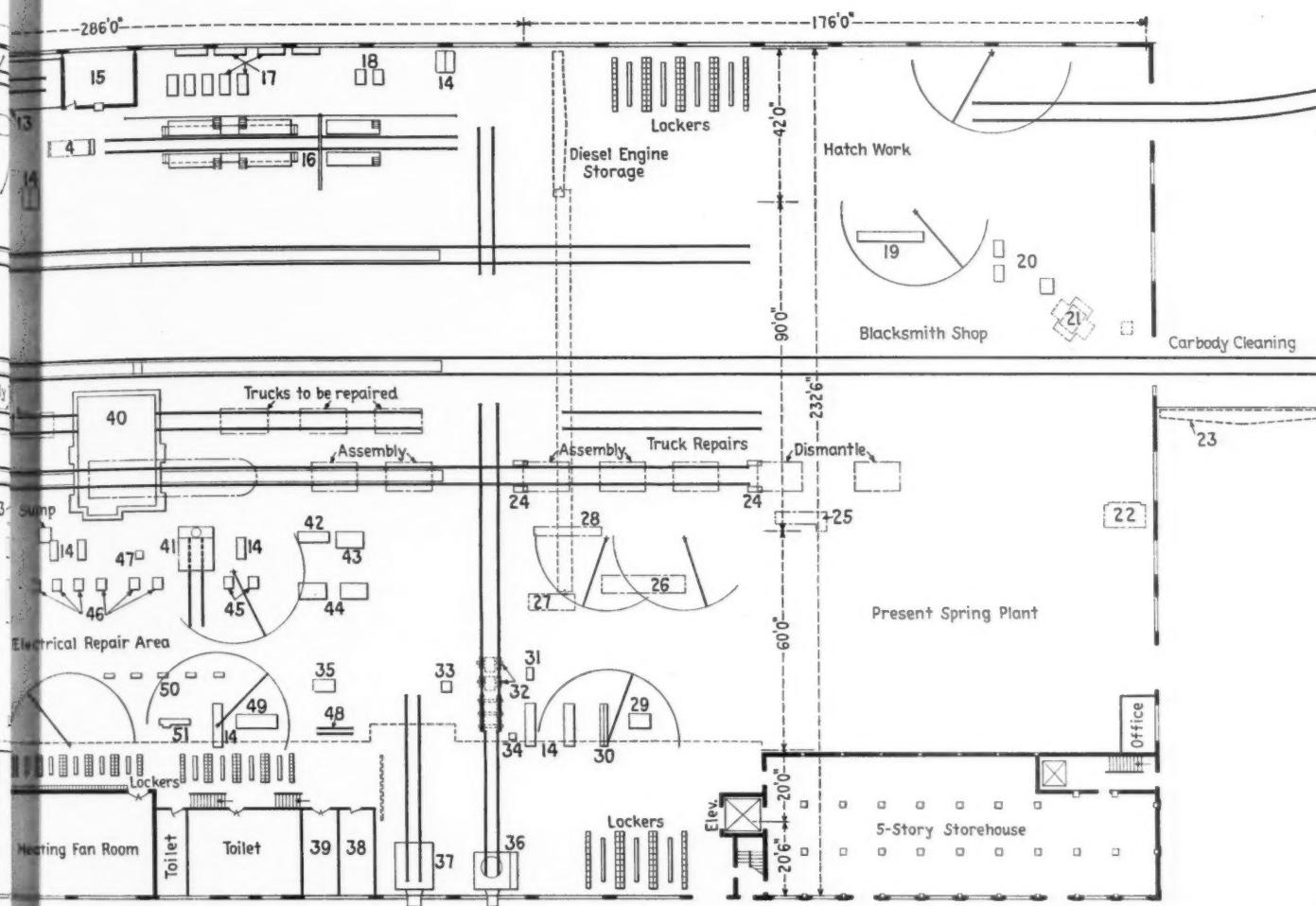
Repairs to B. & O. diesel units are made on a time basis. Every two years each freight unit gets a reconditioned engine and every eight years a complete overhaul. In the Glenwood shop the layout and facilities have been set up to handle the repairs to engines and electrical equipment on a production line basis by utilizing the longitudinal features of this former steam back shop.

The layout, construction details and repair procedures are presented by the keyed floor plan and photographs shown on the following pages. More details of this shop will appear in a later issue.

B. & O. Diesel Shop at Glenwood • • •



B. & O. Diesel Shop at Glenwood • • •



- 12. Cylinder liner honing machine
- 13. Paint spray booth
- 14. Work benches
- 15. Tool room
- 16. Engine assembly position
- 17. Engine parts storage
- 18. Portable piston racks
- 19. Bend rolls
- 20. Blacksmith forges
- 21. 2,000 lb. hammer
- 22. Furnace
- 23. 15-ton crane
- 24. Truck turnover fixture
- 25. Stock adjusting machine
- 26. Punch and shear
- 27. Layout bench
- 28. Pneumatic plate clamp
- 29. Vapor degreaser
- 30. Roller bearing cabinet
- 31. Traction motor stand
- 32. Wheel and motor assemblies
- 33. High potential test
- 34. Pinion heater
- 35. Portable magnetic tester
- 36. Steam cleaning booth
- 37. Gas oven
- 38. Roller bearing inspection
- 39. Office and records
- 40. 90-ton drop table
- 41. Paint spray booth
- 42. Control and test panel
- 43. Portable M. G. set
- 44. Test run equipment
- 45. Frame positioners
- 46. Frame stands
- 47. Pinion heater
- 48. Drying stand
- 49. Commutator grinding lathe

- 50. Armature stands
- 51. Commutator slotter
- 52. Dynamic balancing machine
- 53. 3-ton traveling jib crane

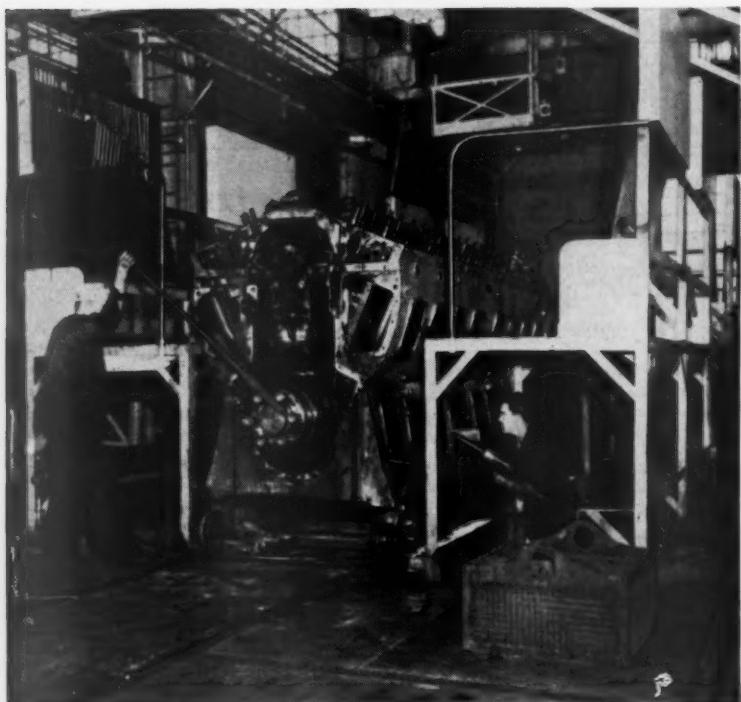
- 54. Electrical repairs to hatch covers
- 55. 60-ton drop table
- 56. Gas oven

- 57. Dirty lube oil tank
- 58. Clean lube oil tank
- 59. Oil and steam lines
- 60. Three-level working area

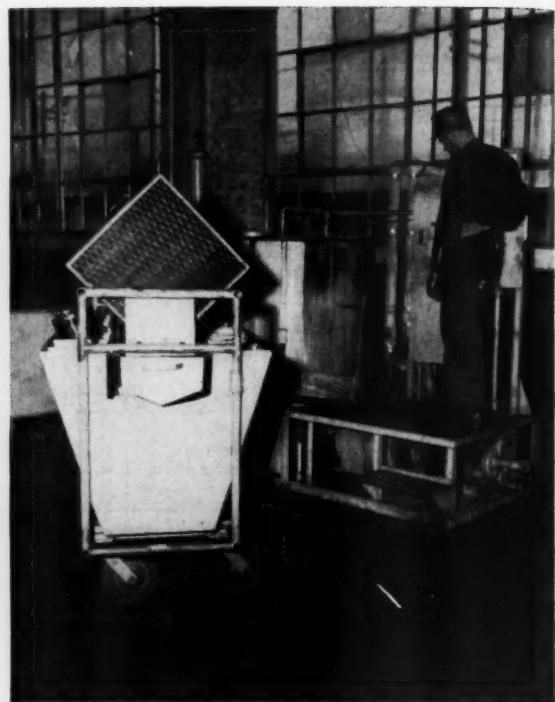


The engine repair bay is laid out for straightline production. Dismantling position is in foreground, cleaning vats at left air-conditioned and dust-proof room for injectors, pumps and governors at left center, and foreman's office and records at right center. Engine assembly position is beyond foreman's office. Note fluorescent lighting.

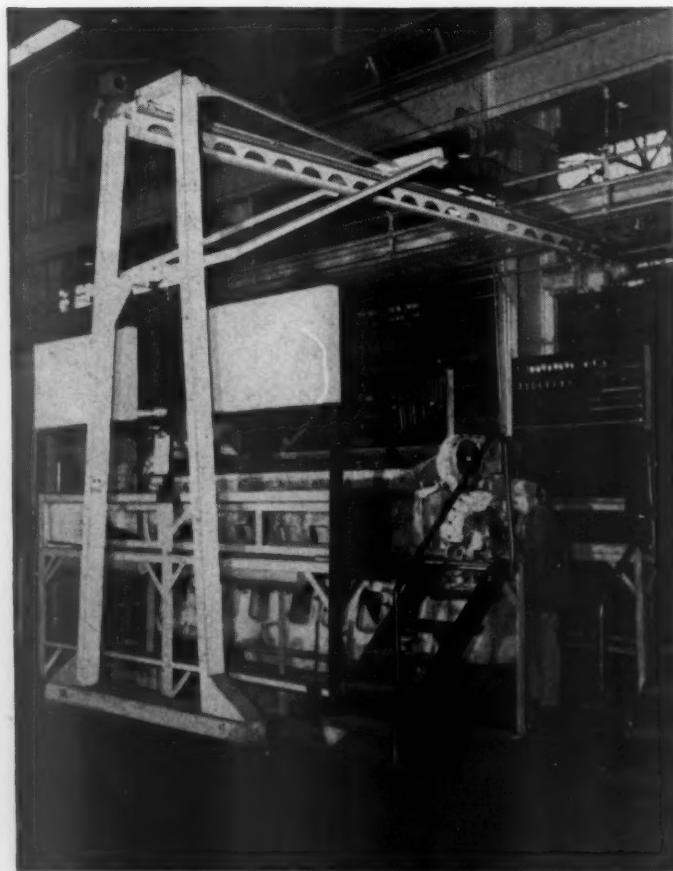
B. & O. Diesel Shop at Glenwood • • •



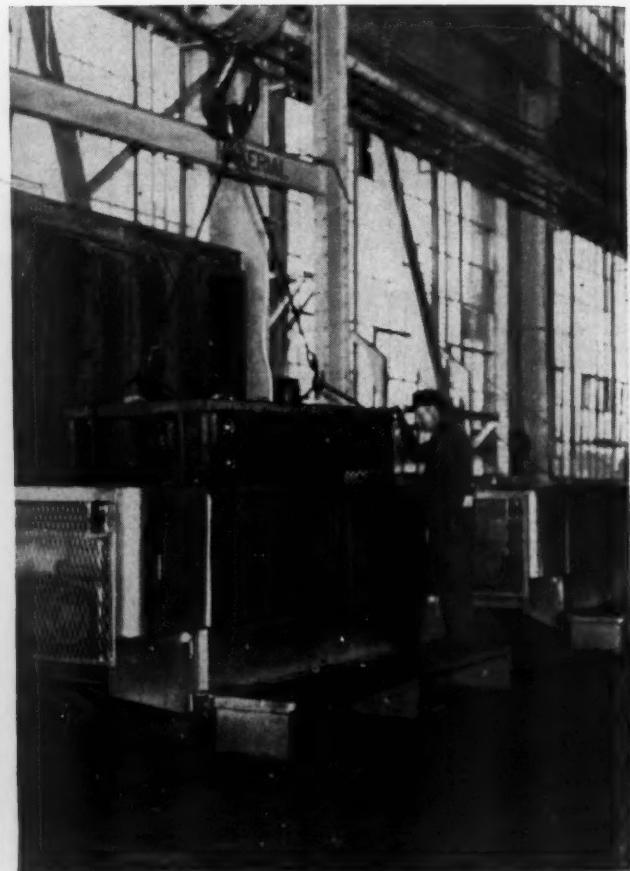
Connecting-rod bearings are removed by impact wrenches as crankshaft is turned to spot the bearings for man in pit.



Filters are cleaned and then transported in wagon that has tank to take drippings.



A one-ton, one-leg gantry crane for handling power assemblies, working platforms and convenient small tools speed up engine repairs



both at dismantling and assembly positions. Small parts are being removed from cleaning tank at right by overhead traveling crane.

B. & O. Diesel Shop at Glenwood • • •



Catalogs and parts lists are readily available in handy racks at entrance to shop office.



Parts are inspected using Magnaglo and Zyglo testing equipment. All parts are checked for defects before repairs are made.

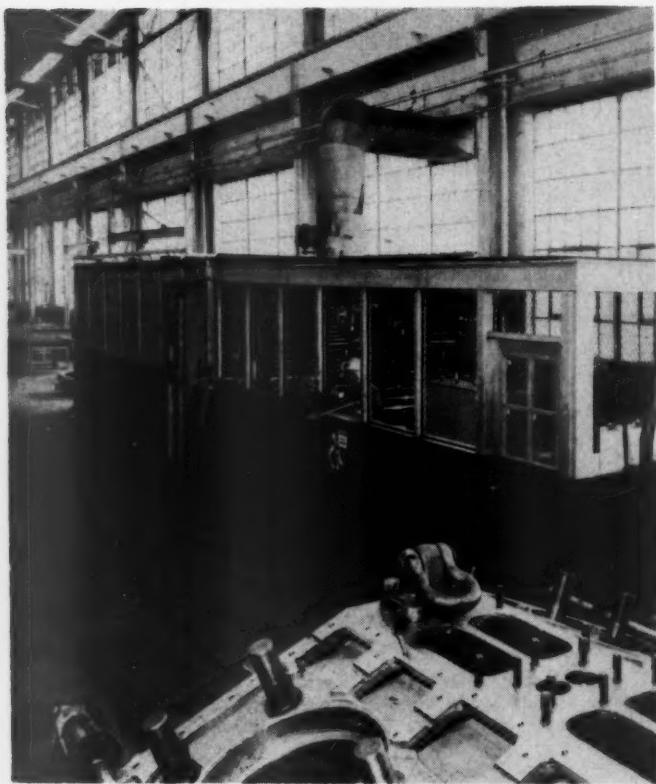


Two rows of repair benches for small parts are served by twin roller conveyor and jib crane with electric hoists. At time this picture was taken the elevator conveyor end had not been installed.

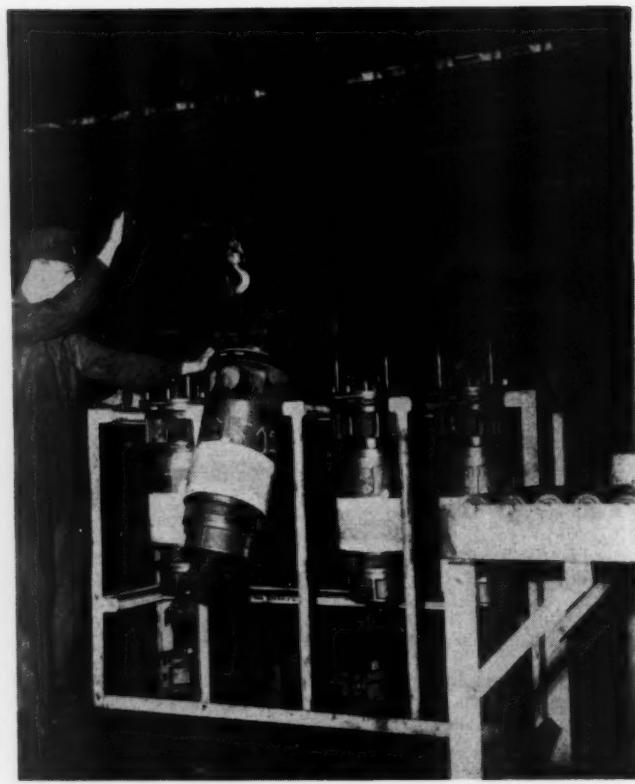


Grinding valve seats in cylinder heads. Air motor raises and lowers roller conveyor end to eliminate heavy lifting by workmen.

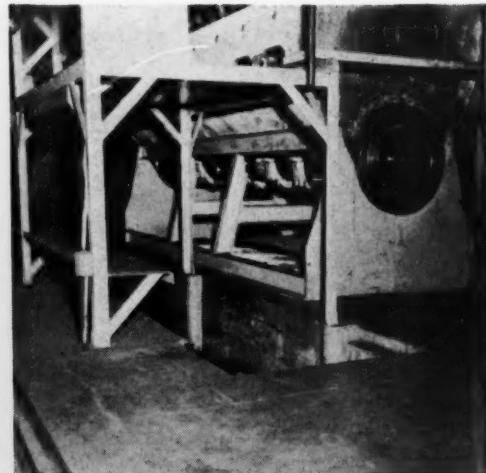
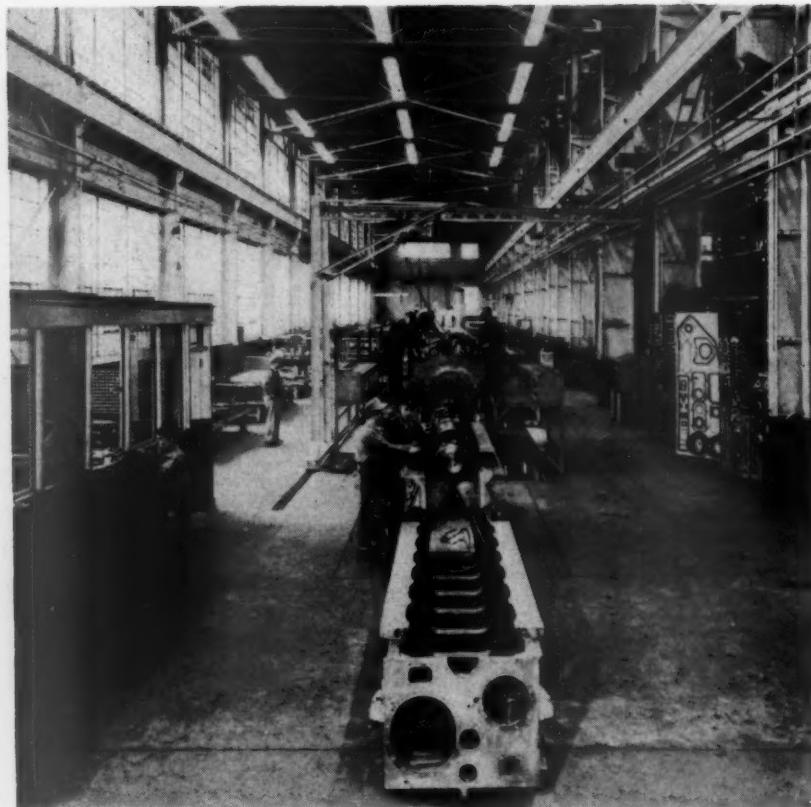
B. & O. Diesel Shop at Glenwood • • •



Tools are neatly arranged on special wall racks in room adjacent to engine assembly position. Paint spray booth adjoins the tool room at left. Shop also has a dust free room for injector, fuel pump and governor repairs.



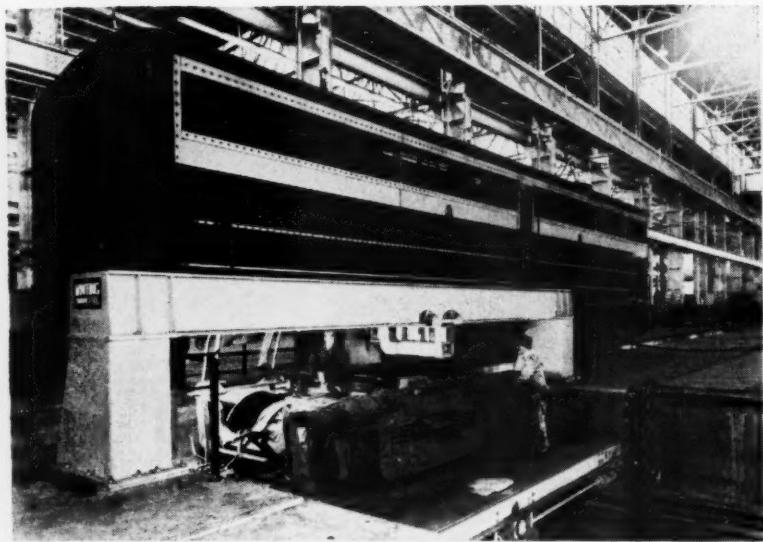
Reconditioned cylinder assemblies are easily lifted out of open-side storage stand. Special lifting device swings power assembly to a position 22½ deg. off vertical so it may be lowered directly into cylinder block.



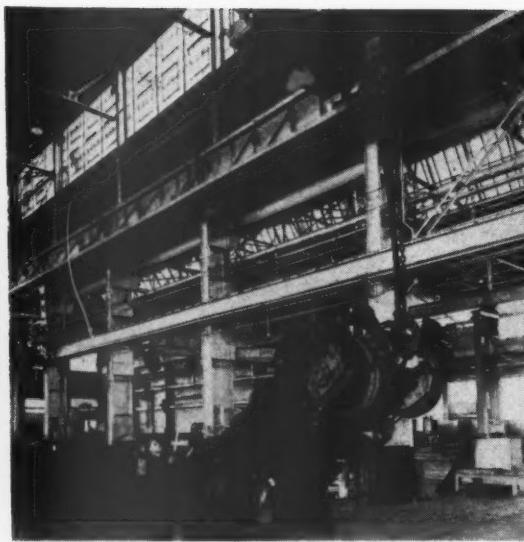
The engine assembly position. A complete set of parts for each engine is stored on benches and in racks and bins at left of assembly position. All types of gaskets are on three-section board at right—each section rotates and has gaskets on reverse side.

At assembly position engine block is lowered onto an open A-frame which permits easy access to connecting rod bearings.

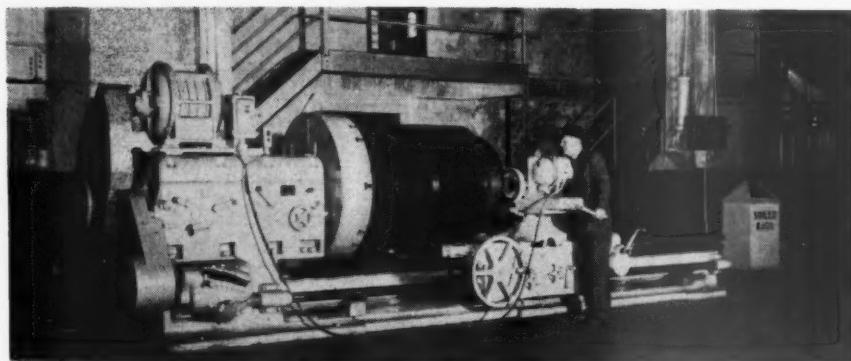
B. & O. Diesel Shop at Glenwood • • •



Trucks are removed and applied on a 90-ton drop table. The shop is equipped with a 60-ton drop table for handling a single pair of wheels and traction motor. By use of a crane and a turnover fixture (right) a four-wheel truck is inverted for work on underside. Wheels and motors are removed; trucks are dismantled;



frames go to cleaning vats, hangers and pins to blacksmith shop. Truck alignment is checked and parts renewed as necessary. The car body is placed on temporary trucks and moved outside of shop for cleaning.



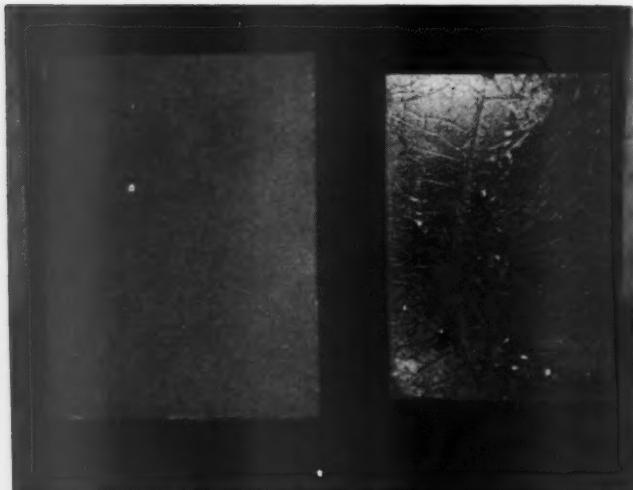
Armatures are ground on this lathe. Motors are reconditioned and balanced on new machine but no rewinding is done at shop.



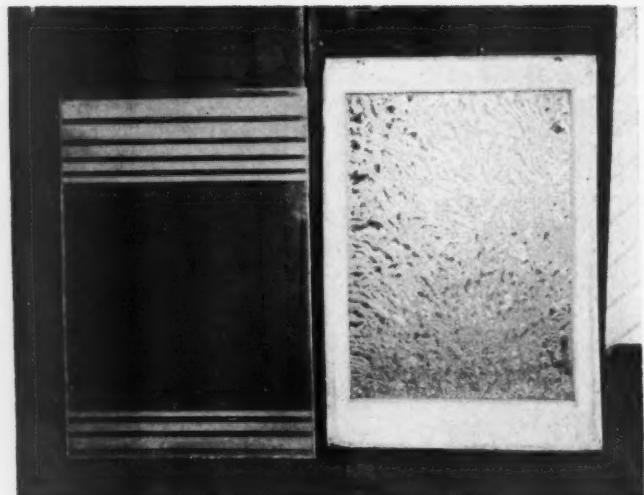
New wash room (left) with circular fountains and soap dispensers. A new shower room adjoins wash room. Training of employees in diesel maintenance is con-



ducted in class room on balcony (right). Room is equipped with charts, blackboard, projector and recorder. The latter permits lectures to be sent to master mechanics at other locations.



The first step in making frosted glass is to sandblast lightly (left), after which boiling hot wood glue is poured over the surface and allowed to dry (right).



The pane on the right shows how the completed shop-made frosted glass looks while the pane on the left was made by light sandblasting only after covering the clear section with scotch tape.

Grand Trunk Makes Own Frosted Glass

The Grand Trunk Western makes frosted glass for cars on the entire system in three simple steps. The first step is to sandblast one side of the glass to roughen the surface. Regular equipment is used but at a lower air

pressure than would be used for stripping paint off freight cars to avoid damaging the glass. Boiling hot wood glue is then poured over the entire surface and allowed to cool and dry. The cooled and dried wood glue peels off easily, and the glass is ready for use.

Decorative designs of the type shown in one of the illustrations are obtained by first covering the portions of the glass that are to remain transparent with scotch tape. The uncovered sections are then sandblasted lightly.

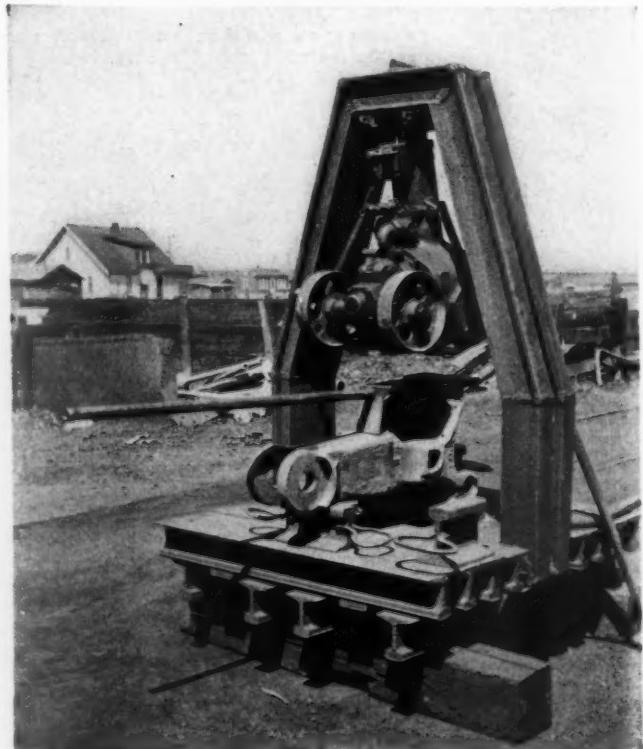
Coupler Jaw Press

The men at the East St. Louis shops of the Alton and Southern have built a press to squeeze coupler jaws back together after the opening has become enlarged from coupling impacts. The press is composed of a heavy steel supporting frame from which a 50-ton air jack is suspended. Both the bed and the side framing are made from secondhand steel rails.

Couplers with spread jaws are heated to 1,600 deg. F. and kept at that temperature one hour for annealing and stress relieving. The coupler is placed on the press at the same 1,600 deg. and the jaws squeezed back to gage size by the air jack. The coupler is then returned to the furnace for controlled cooling to 500 deg.

The jack is easily removable because of the method of attachment to the press. Two 1/4-in. angles welded to the underside of the top frame member support the jack by the collar on top of the shaft. The long-handled die shown in the illustration has two plates welded on it near the end to apply force at the right place and in the right direction.

Press with removable air jack to squeeze back together coupler jaws which have been spread in service.



Questions and Answers

Diesel-Electric Locomotives*

COOLING WATER TEMPERATURE CONTROL HIGH WATER TEMPERATURE SWITCH

664-Q.—What kind of unit is the Temperature Switch?

A.—A remote bulb unit with an enclosed snap switch.

665-Q.—How is the switch actuated?

A.—Temperature changes at the bulb are transmitted as pressure changes, through the flexible tubing to the bellows 9 which in turn actuates the switch 2.

666-Q.—How is the switch connected to the circuit?

A.—The switch is connected so as to open the circuit when the temperature of the water in the header out of the engine reaches 185 deg. F.

667-Q.—How is the control point adjusted?

A.—Turning the temperature screw 1 changes the control point by increasing or decreasing the tension of spring 4, and moves the temperature setting indicator 6 along the scale.

668-Q.—Describe the indicator reading.

A.—The indicator reading is the temperature at which the switch makes contact in the direct-action circuit and breaks the reverse-action circuit on a drop in temperature.

669-Q.—What is the meaning of the term "differential"?

A.—The differential in this case means the rise in temperature from scale setting to the point where the switch trips the other way.

670-Q.—Should any attempt be made to adjust the differential in the field?

A.—No. This adjustment is made at the factory and is non-adjustable in the field.

671-Q.—What is the approximate differential?

A.—5 deg. F.

GENERAL ELECTRIC CONTROL

672-Q.—What functions to operate the radiator shutters?

A.—The radiator shutters are operated by air cylinders.

673-Q.—What is the action of the air cylinders which control the operation of shutters on freight and passenger locomotives?

A.—These air cylinders are double acting.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives. The figure numbers and references, by number, to diagrams, etc., relate to the current edition of the Alco-G.E. operating and maintenance manual.

674-Q.—What causes the shutters to open on the above locomotives?

A.—Air piston rods are connected by means of linkage to the shutters. Admission of air to one end of the cylinder will open the shutters.

675-Q.—What causes the shutters to close?

A.—Admission of air to the other end of the cylinder will close the shutters.

676-Q.—Where are these cylinders located on freight and passenger locomotives?

A.—One on each interior side wall of the engine room, near the compressor.

677-Q.—What is the action of the air cylinders on road switchers?

A.—These air cylinder are single acting.

678-Q.—How do the cylinders function to operate the shutters?

A.—Main reservoir pressure is used to close the shutters, and they are opened by spring action.

679-Q.—Where are the cylinders located on road switchers?

A.—One on each side of the exterior wall of locomotive engine hood, just behind the radiators.

680-Q.—What is the Shutter Magnet Valve?

A.—A solenoid operated air valve.

681-Q.—What functions to operate this valve?

A.—It is controlled by the radiator fan relay.

682-Q.—Where is the shutter magnet valve located on freight and passenger locomotives?

A.—It is located on the expansion tank bulkhead above the shutter air cylinder, on the fireman's side.

683-Q.—Where is the shutter magnet valve located on road switchers?

A.—On the front bulkhead of the engine hood.

684-Q.—What action takes place when the diesel engine water is cool?

A.—When the diesel engine water is cool the radiator fan relay will energize the shutter magnet valve.

685-Q.—With the shutter magnet valve energized, what takes place?

A.—On all three types of locomotives the energized shutter magnet valve admits main reservoir air to the bottom of the shutter air cylinder.

686-Q.—How does this affect the shutters?

A.—The shutters are closed.

687-Q.—What takes place when water temperature rises and cooling action is needed?

A.—The radiator fan relay de-energizes the shutter magnet valve.

688-Q.—On freight and passenger locomotives what takes place when the shutter magnet valve is de-energized?

A.—The de-energized shutter magnet valve admits main reservoir air to the top end of the shutter air cylinder and releases air from the bottom end.

689-Q.—How does this flow of air affect the shutters?

A.—The shutters are opened.

690-Q.—Explain this operation on road switchers.

A.—The shutter magnet valve releases air from the bottom of the cylinder and the shutter springs open the shutters.

691-Q.—What device is used to control shutter operation on locomotives built in 1946-47?

A.—A Kysor Shutterstat is used instead of the shutter magnet valve.

692-Q.—What controls the shutterstat and where is it located?

A.—The shutterstat is controlled by engine water temperature and is located in the left engine water outlet header.

693-Q.—What type radiator fan relay is used on freight and passenger locomotives?

A.—The type LM-30-C radiator fan relay is used on freight and passenger locomotives built in 1946-47-48. Later locomotives use the Minneapolis-Honeywell fan control.

694-Q.—What type is used on road switcher locomotives?

A.—A combination of Type LM-31-B and Type LM-32-B relays forms the radiator fan relay used on the road switchers built in 1946-47-48. Later locomotives use the Minneapolis-Honeywell fan control.

695-Q.—Does the relay control shutter action similar to the operation of the Shutter Magnet Valve (SMV)?

A.—Yes, the action is similar.

696-Q.—Where is the radiator fan relay located on freight and passenger locomotives?

A.—In the Engine Control Panel in the engine room.

697-Q.—Where is it located on road switchers?

A.—The relay equipment is divided. The temperature measuring device (LM-31-B) is located on the front bulkhead of the engine hood and the motor driven rheostat (LM-32-B) is located in the engine control panel in the engineman's cab.

EDDY CURRENT CLUTCH

698-Q.—What is the Eddy Current Clutch?

A.—A two-piece magnetic type coupling.

699-Q.—How is the coupling mounted?

A.—One coupling half is mounted on the air compressor shaft extension and revolves at engine speed. The other half is mounted on the radiator fan gear unit horizontal shaft.

700-Q.—What is contained in the latter half?

A.—The clutch field winding.

Schedule 24 RL

Air Brakes

1448-Q.—What results from the closing of inshot supply valve?

A.—The 7-lb. pressure in chamber *P* is retained, thus maintaining this inshot pressure directly on diaphragm 38 while further build-up of pressure in the diaphragm portion is controlled by the position of the magnet valves.

1449-Q.—How does the speed governor function at train speeds of less than 20 miles per hour?

A.—At train speeds of less than 20 miles per hour the speed governor closes the low speed (LS) magnet circuit.

1450-Q.—What happens as this circuit is closed?

A.—The magnet coil is energized pulling down its armature and stem thereby seating the lower magnet valve and unseating the upper magnet valve 161a.

F.S. 1864 RELAY VALVE

1451-Q.—What flow of air then takes place?

A.—Inshot air flows through choke 142, past upper magnet valve 161a, through passages 17 and 17a to diaphragm chamber *K*, thus balancing the inshot pressure on all diaphragms.

1452-Q.—What is the position of the lower magnet valves at this time?

A.—The lower magnet valves 161, 161a and 161b are closed.

1453-Q.—What takes place with the lower magnet valves closed?

A.—Additional application pressure from passage 16a can build up only in diaphragm chamber *A* and act on the smallest diaphragm 60.

1454-Q.—How does this react on the main diaphragm 38?

A.—As the area of diaphragm 60 is 40 per cent of the main diaphragm, only 40 per cent of the pressure in chamber *A* will be transferred through the diaphragm stack to the main diaphragm.

1455-Q.—What is the final result of this set-up?

A.—Brake cylinder pressure builds up to approximately 40 per cent of chamber *A* pressure, thus balancing pressure on both faces of diaphragm.

1456-Q.—How is the Low Speed (L.S.) magnet affected when train speed exceeds 22 m.p.h.?

A.—When train speed exceeds 22 m.p.h., the speed governor de-energizes the L.S. magnet.

1457-Q.—What action follows the de-energization of the L.S. magnet?

A.—Spring 162a seats upper magnet valve 161a and unseats lower magnet valve 161a.

1458-Q.—What is the air flow under these conditions?

A.—Air from passage 16 flows through passages 17

and 17a to chamber K, where it builds up on diaphragm 64.

1459-Q.—What is the result when pressure builds up on diaphragm 64?

A.—Diaphragm 64 is 60 per cent of diaphragm 38, therefore the brake cylinder pressure reproduced in cavity F by the relay portion is 60 per cent of that in chamber K.

1460-Q.—What takes place when train speed exceeds 44 m.p.h.?

A.—The speed governor then energizes the medium speed (M.S.) magnet coil.

1461-Q.—With the M.S. magnet coil energized, what takes place?

A.—The magnet valve pulls down its armature and stem seating under magnet valve 161 and unseating lower magnet valve 161.

1462-Q.—What flow of air follows this action?

A.—Air from passage 16 flows through passages 18 and 18a to diaphragm chamber N where it builds up on diaphragm 68.

1463-Q.—Under these conditions, what pressure is reproduced in the brake cylinder?

A.—As this diaphragm area is 80 per cent of main diaphragm 38, the pressure reproduced in brake cylinder and chamber F is 80 per cent of that in chamber N.

1464-Q.—When train speed exceeds 69 m.p.h., how does the speed governor function?

A.—The speed governor acts to energize the High Speed (H.S.) magnet coil.

1465-Q.—At this time is the M.S. magnet coil deenergized?

A.—No. The M.S. magnet coil is still energized.

1466-Q.—When the H.S. magnet coil is energized, what is the resulting movement?

A.—Its armature and stem are pulled down, seating the upper magnet valve 161b and unseating the lower magnet valve 161a.

1467-Q.—What is the resulting air flow?

A.—Air from passage 16 flows through passages 19 and 19a to cavity P where it acts directly on main diaphragm 38.

1468-Q.—What pressure is reproduced in the brake cylinder?

A.—Brake cylinder pressure is reproduced equivalent to chamber P pressure and laps off.

1469-Q.—During the operation of this type of relay valve, what braking ratios are thus provided for?

A.—The operation of the diaphragm stack as controlled from the speed governor thus provides four braking ratios of 40, 60, 80 and 100 per cent, which limit braking force in proportion to train speed.

1470-Q.—Under what brake application does this apply?

A.—Throughout the entire range of service, independent and emergency operations.

1471-Q.—How does the speed governor function when the train speed reduces?

A.—As the train speed reduces, the speed governor functions to reduce the brake cylinder pressure in proportion to the reduction in train speed.

1472-Q.—What results when the speed is reduced below 65 m.p.h.?

A.—As speed reduces below 65 m.p.h. the speed governor de-energizes the High Speed (H.S.) magnet.

1473-Q.—What takes place when the H.S. magnet is de-energized?

A.—Spring 162b seats the lower magnet valve 161b, cutting off supply to diaphragm chamber P, and unseats upper magnet valve 161b.

1474-Q.—Trace the flow of air resulting from above action?

A.—The air in diaphragm chamber P then flows through passages 19a and 19 past upper magnet valve 161b, choke 138 and passage 15 to inshot chamber C and through passage 15a to exhaust valve 93.

1475-Q.—What movement takes place when air flows into inshot chamber C?

A.—The air in inshot chamber C deflects diaphragm 85 against the tension of spring 88, moving piston 84 to unseat exhaust valve 93.

1476-Q.—With the exhaust valve unseated, what happens?

A.—Passage 15a is opened to the exhaust, connecting diaphragm chamber P to the atmosphere.

1477-Q.—Is the air in chamber P reduced to zero?

A.—No. Only to 7 lb. inshot pressure.

1478-Q.—What happens when the pressure is thus reduced to seven lb.?

A.—Spring 88 returns piston 84, permitting exhaust valve 93 to be closed by spring 94.

1479-Q.—As the medium speed magnet is still energized, what ratio is now established?

A.—80 per cent ratio for braking, on diaphragm 68.

1480-Q.—How does the relay portion function at this time?

A.—The relay portion now operates to make a corresponding release of brake cylinder air.

1481-Q.—How does the speed governor operate as speed reduces below 40 m.p.h.?

A.—At this time the speed governor de-energizes the medium speed (M.S.) magnet.

1482-Q.—What is the result of this operation?

A.—Pressure in diaphragm chamber N is released through choke 140 and the inshot portion exhaust and establishes the 60 per cent braking ratio on diaphragm 64.

1483-Q.—How does the speed governor function as the speed reduces below 20 m.p.h.?

A.—The speed governor energizes the Low Speed (L.S.) magnet.

ELECTRICAL SECTION



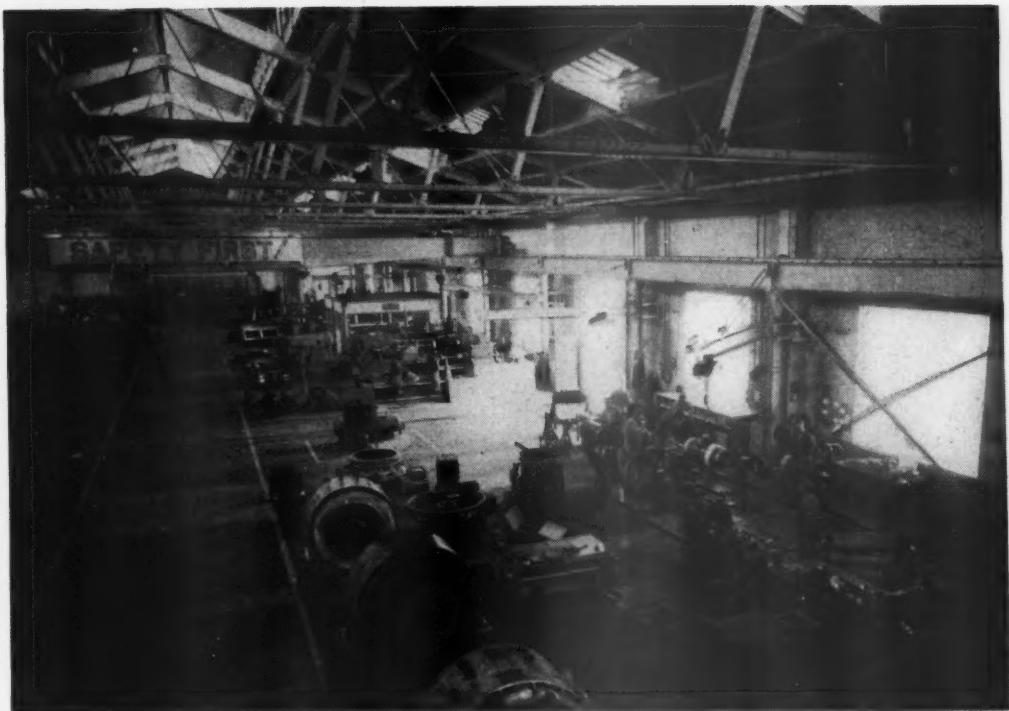
General view of the left side
of the shop showing baking
ovens, impregnator, pot sol-
dering machine and brazing
machine

The Northern Pacific's South Tacoma Electric Shop



Center section of the shop in
which motors are disassem-
bled, reassembled and tested

Right side of the shop showing the armature winding section, lathe, banding machine, balancing machine, office, etc.



Railroad performs all its heavy electrical repair work in one shop which is reduced to bare but apparently adequate essentials

THE Northern Pacific's electrical shop at South Tacoma, Wash., is primarily a facility for overhauling and making heavy repairs to diesel-electric locomotive electrical equipment. It also rewinds and overhauls general purpose motors and generators used all over the railroad. The electrical shop works one eight-hour shift a day, and normally employs 52 men.

Passenger locomotive traction motors are overhauled

at 300,000-mile intervals and freight locomotive traction motors between 200,000 and 300,000 miles. Motors due for overhaul are changed out at South Tacoma, Wash., St. Paul, Minn., Glendive, Mont., and Auburn, Wash. Spare overhauled motors are kept at these points to replace those changed out. Drop tables are used for this purpose. The motors are shipped on skids which are designed for this purpose.

Section of the shop given over to the repair of shop and general purpose motors, air conditioning and car lighting motors and generators, and auxiliary diesel locomotive equipment

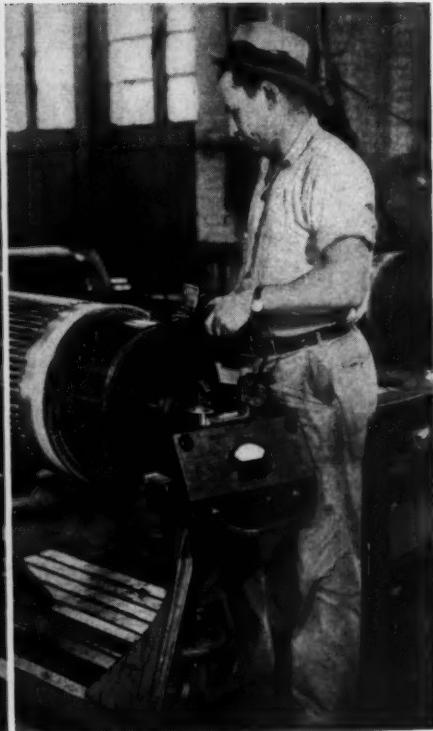




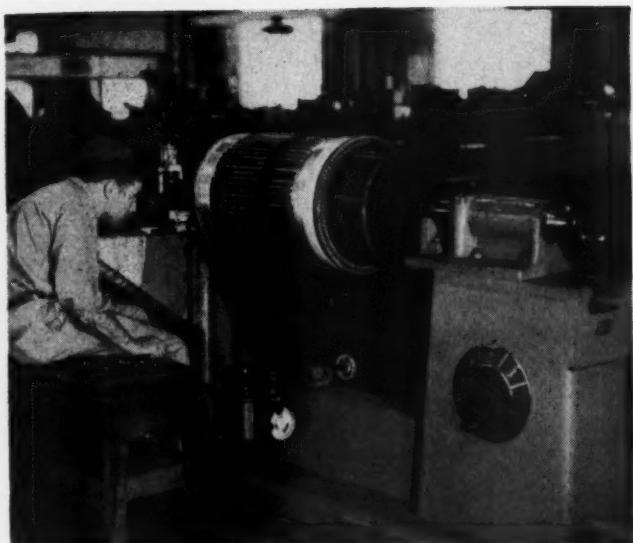
Above: The a.c. end of an E.M.D. generator showing the condition in which they are usually received in the shop

Upper right: An a.c. generator stator after it has been cleaned

Lower right: A generator end frame showing the quality of work done on the cleaning rack



Left: The high-potential tester is used as a check throughout the process of overhauling and rewinding motors. Center: The Ducter as used for making bar-to-bar tests. Right: The electronic armature tester in service



(Upper left) — The brazing machine in service



(Upper right) — Commutators of rewound motors and those of overhauled motors which need it, are turned and undercut



An armature goes into the impregnator



Risers and coil ends are soldered in a pot soldering machine

The tractor and one of the trailer wagons used to haul material



The shop is 86 ft. wide and 230 ft. long, not including the sub storeroom and tool room at one end. It is equipped with one floor-operated, 10-ton crane, serving the entire floor area and 11 jib cranes, each having a 12-ft. reach and a 2-ton electric hoist. The shop is lighted by 42 overhead fixtures, each containing one 400-watt, high-intensity mercury vapor lamp and three 150-watt incandescent lamps. This arrangement produces good color with high efficiency. The principal equipment in the shop is shown in the table.

PRINCIPAL EQUIPMENT:

- 1 20-in. lathe
- 1 36-in. lathe
- 2 Balancing machines
- 2 Electric baking ovens
- 1 Impregnator
- 1 Commutator soldering pot
- 1 Banding machine
- 1 Brazing machine
- 1 300-ton press
- 2 Drill presses
- 2 Grinders
- 1 M.G. set for driving traction motors
- 1 High-potential testing machine equipped for burning
- 2 Portable high-potential testing machines used largely for field testing
- 1 Ducter tester
- 1 Electronic armature tester for making bar-to-bar tests
- 3 Megger insulation testers
- 1 Welding machine
- Portable voltmeters and ammeters
- Tong test meter for measuring amperes
- Armature and motor stands

One electric truck and one Clark gasoline lift truck are used for handling material on trailer wagons on the floor.

Overhaul

Traction motors, when brought in for general overhaul, are first dismantled at a point near the center of the shop in a progressive line or spot system. All parts are put on trailers and moved outside to a cleaning rack where they are spray cleaned with a cleaning solvent and thoroughly dried with air and then distributed to the

designated spots in the shop where men with special training recondition or renew them.

Bearing support housings, bearing caps and motor end housings are steam cleaned. Bearings that have not received their mileage and are in good condition are thoroughly cleaned and given a coating of oil. All traction motors received with grease lubricated bearings are being converted from grease lubricated bearings to oil lubricated bearings.

If the armature shaft is not worn, the next operation is to Magnaflux it. If the shaft is found to be in good condition, the armature is then given a Megger test and high-potential test. Commutators are turned when necessary (not ground), and are undercut with a milling cutter. New bands are applied when necessary. This is not a frequent requirement. Then Megger tests and Ducter tests are made after which the armature is spray-painted with Glyptol insulating enamel. Armatures are balanced on a dynamic balancer. When bearing or spider fits of armature shaft are worn, they are metal sprayed and ground to proper size. The surface is prepared for spraying by turning.

Frames are also cleaned with cleaning solvent. They are given Megger, Ducter and high-potential tests, and are then sprayed with Glyptol insulating enamel.

Brush rigging is overhauled. After the motors are reassembled, they are run light for 30 minutes at 1,350 r.p.m. During this run, the bearings are checked and brushes properly seated. While motors are still warm, they are given another high-potential test at 1,500 volts.

Generators are put through the same routine with the exception of the running test.

Rewinding

All rewinding of traction motors and generator armatures is done in the South Tacoma shop. The shop also handles the rewinding of locomotive auxiliary motors and all shop and general purpose motors for the system.

When traction motor armatures require rewinding, the armature is placed in a lathe and the coils are cut at both ends with a parting tool and pulled out of the slots with a come-along and an electric hoist on a jib crane. Core slots are cleaned by hand with file and scraper, also with a portable grinder, using $\frac{1}{8}$ -in. x 3-in. Bayflex wheel, depending upon condition of grooves. Coil ends

are removed from the risers by heating the risers and knocking them out with a power hacksaw blade. The riser slots are then cleaned with a motor-operated reciprocating file.

The commutator is given a 3,000-volt ground test and a bar-to-bar test at 220 volts. The risers are fluxed with resin flux, after which the equalizers are installed and hot-banded. A bar-to-bar test of every other bar is made at 220 volts and a second high-potential test is made at 3,000 volts.

Insulation and main coils are installed and hot-banded at 480 lb. tension, using iron bars on top of each coil. After cooling, the temporary bands are removed and wedges are driven into the coil slots. This operation is followed by another high-potential test at 3,000 volts. Pinion-end clips are then brazed and insulation installed. Fillers are installed in risers and the risers are faced in a lathe. The coils are soldered to the risers by the pot soldering method. The armature is then given a Ducter

test and a high-potential test at 3,000 volts, after which permanent bands are applied in the banding machine. Bands are not re-rolled. The rewound armature is put into the impregnator, where it is kept under vacuum for 15 to 30 minutes. Varnish is then admitted, and a pressure of 20 to 25 lb. applied, using CO₂ gas for pressure, for a period of about 1½ hours. The armature is then removed from the impregnator and placed in an oven where it is baked for 24 hours at 250 deg. F. After baking, it is dipped into the impregnator at atmospheric pressure, and then baked again at 250 deg. F. for 18 hours. The armature then receives a Megger test and another high-potential test at 2,500 volts.

The commutator is turned and undercut and given a Ducter test, after which the armature is sprayed with Glyptol enamel. Finally, the armature is balanced in the dynamic balancing machine, after which it is ready for assembly in a motor. The procedure used for rewinding generator armatures is essentially similar.



Left: The outer cylinder screws into the pinion and the wedge, when driven into the slot, forces the inner cylinder against the motor shaft.
Right: A few blows with the hammer pull the heated pinion from the motor shaft

Wedge Puller for Pinions

A single wedge puller developed in the Barstow, Cal., shops of the Atchison, Topeka and Santa Fe provides an effective means of removing traction motor pinions after they have been heated by a National Electric heating coil.

The body of the device is a steel cylinder, 6 in. long, having an outside diameter of 5½ in. and an inside diameter of 3 in. The cylinder is threaded at one end to fit the threads of the pinion. At the other end, it is fitted with two handles, 180 deg. apart, which are used to screw the cylinder into the pinion after the pinion nut is removed.

The second part of the device is a solid steel cylinder 3 in. long, and just large enough in diameter to slide

freely in the outer hollow cylinder. There is a rectangular slot in the outside cylinder near the handle end which extends laterally through the cylinder.

When in service, the outer cylinder is screwed into the pinion, and when the inner cylinder is fitted inside, it touches the end of the shaft and extends outward half way across the slot. One of the two wedges supplied with the pinion heater is then placed in the slot. When the pinion has reached the right temperature, a few blows with a hammer on the upper end of the wedge forces the inner cylinder against the shaft, and pulls off the pinion.

This arrangement aligns the pulling forces with the motor shaft, and avoids possible damage to the bearing which might be caused by placing wedges back of the pinion.

DIESEL-ELECTRICS—How to Keep 'Em Rolling

15

Some Simple Battery Circuits

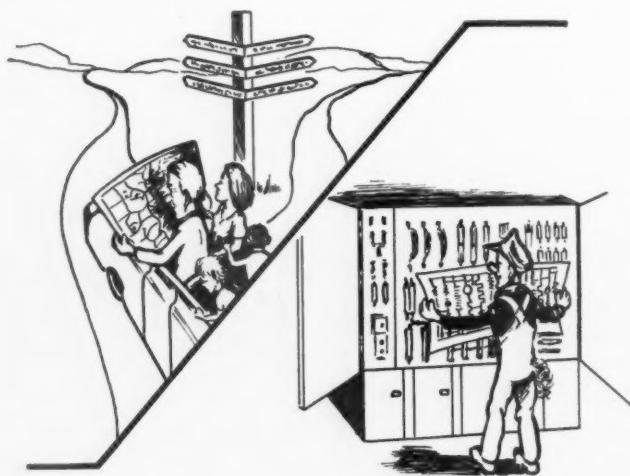


Fig. 1—A wiring diagram is like a road map

IF you have ever driven the family jalopy further than the corner grocery, you have probably used a road map. Perhaps the first time you tried, you thought the map was more confusing than the roads. But a little study showed you it was really a big help in finding your way around. On the map, you can see what roads you have to choose from, what kind they are, and where they go. Cities, parks, vacation spots, forests and many other things are marked on the map. Most of these are shown by symbols. That keeps the map from getting cluttered up with a lot of writing. The purpose of a highway map is to help you find your way in your travels. As you know, maps aren't all exactly alike. However, they all used about the same symbols, so that if you can read one, you can read them all. The same thing is true of working diagrams.

The Wiring Diagram

The two principal wiring diagrams for a locomotive are the *main* diagram and the *schematic*. The schematic diagram is very much like a highway map. It is the one you will use most of the time. Lines are used to show the electric circuits, or highways. Symbols are used to show the devices in these circuits, or the cities. This and other useful information is put together to form a diagram, or electrical *map* to help you in tracing out circuits and locating trouble on a locomotive.

This is the fifteenth of a series of articles on the maintenance of diesel-electric equipment. This article is written by J. L. Judy and W. S. O'Kelly, both of the Locomotive and Car Equipment Department, General Electric Company, Erie, Pa.

On an auto trip you usually start out from home, follow whatever route you choose, and end up back at home. Electricity behaves in much the same way. It starts from a source,—a battery or a generator,—travels through circuit wires, and ends up where it started. In traveling you do not necessarily end up back home. Electricity is different. It won't start out unless there is a complete circuit (road) back to the source.

You have got to have a source of electricity before you can have current flowing in a circuit. On a locomotive, this is either a battery or a generator. A battery is used to supply power for lighting, engine starting, etc., when the engine is not running, much the same as the battery in your automobile. The diesel engine drives the main and auxiliary generators. When it is running, these are the current sources, Fig. 2. The main generator furnishes current to the traction motors which drive the locomotive. The exciter supplies current to the main generator field. The battery charging generator furnishes current for recharging the battery and for the control circuits. The blower generator supplies current to the blower motors which furnish cooling air to the traction motors. Some

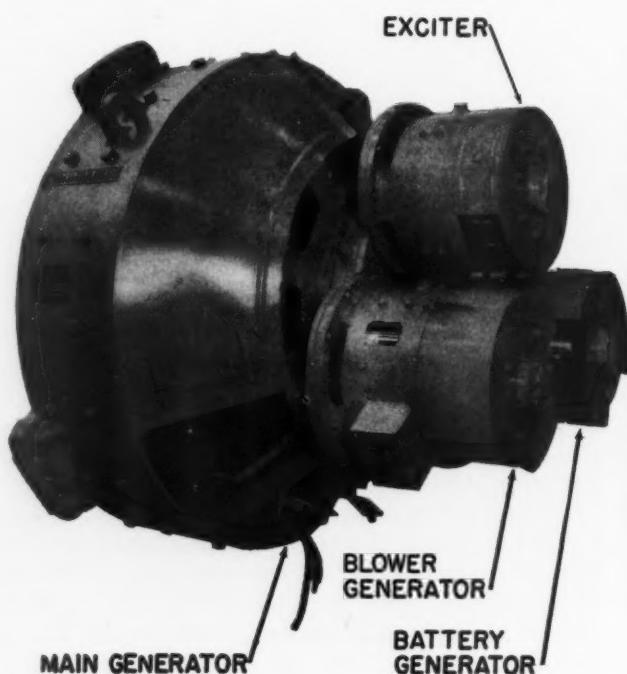


Fig. 2—Main generator with gear-driven auxiliaries used on Alco-GE road-type locomotives

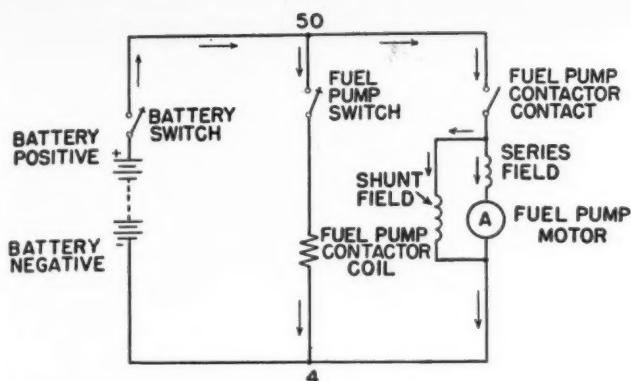


Fig. 3—Simple diagram of a fuel pump motor circuit

locomotives do not have a blower generator. Then the blower fan may be driven direct from the engine. On some locomotives, there are no traction motor blowers.

The Fuel Pump Circuit

Let's trace out one of the highways on the electrical map. It has been drawn separately in Fig. 3 to make this easy. Here you see a battery, a fuel pump contactor coil, its contacts, and a fuel pump motor. All switches and contacts are shown in their normal position, that is with no power on. Remember, all devices on any wiring diagram are shown this way.

The fuel pump has the job of pulling the fuel out of the tank and delivering it to the engine. It "shovels the coal" to the diesel. The first step in starting this pump is to close the battery knife switch. This connects the battery positive to the 50 wire. But though the 50 wire is now "hot," nothing will happen because there is no path from it to the 4 wire, or battery negative. So next, you close the fuel pump switch and, make such a path.

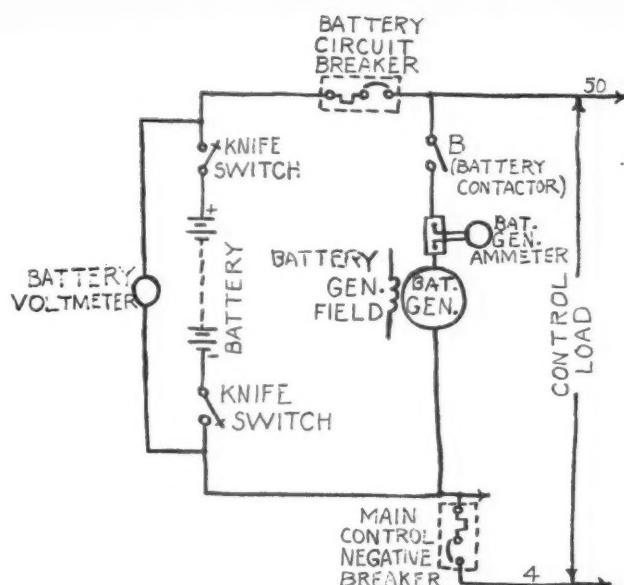


Fig. 5—Sketch of battery power circuit

The current can now flow from the 50 wire through this switch and the fuel pump contactor coil to the 4 wire. This contactor is of the magnetic type, so it closes, or "picks up," when current flows through its coil. When it "picks up," its contacts—marked *FPC* in the circuit at the right of Fig. 3—close. Now there is a path from the 50 wire down through the fields and armature of the fuel pump motor to the 4 wire. Current flowing through this path starts the motor. This drives the pump and furnishes fuel to the engine.

Electricity is always trying to find a way to get from the 50 wire to the 4 wire. It will go through coils, motors, etc., but it would much prefer a straight, easy path. Sometimes it finds this, and then we have what is called a short

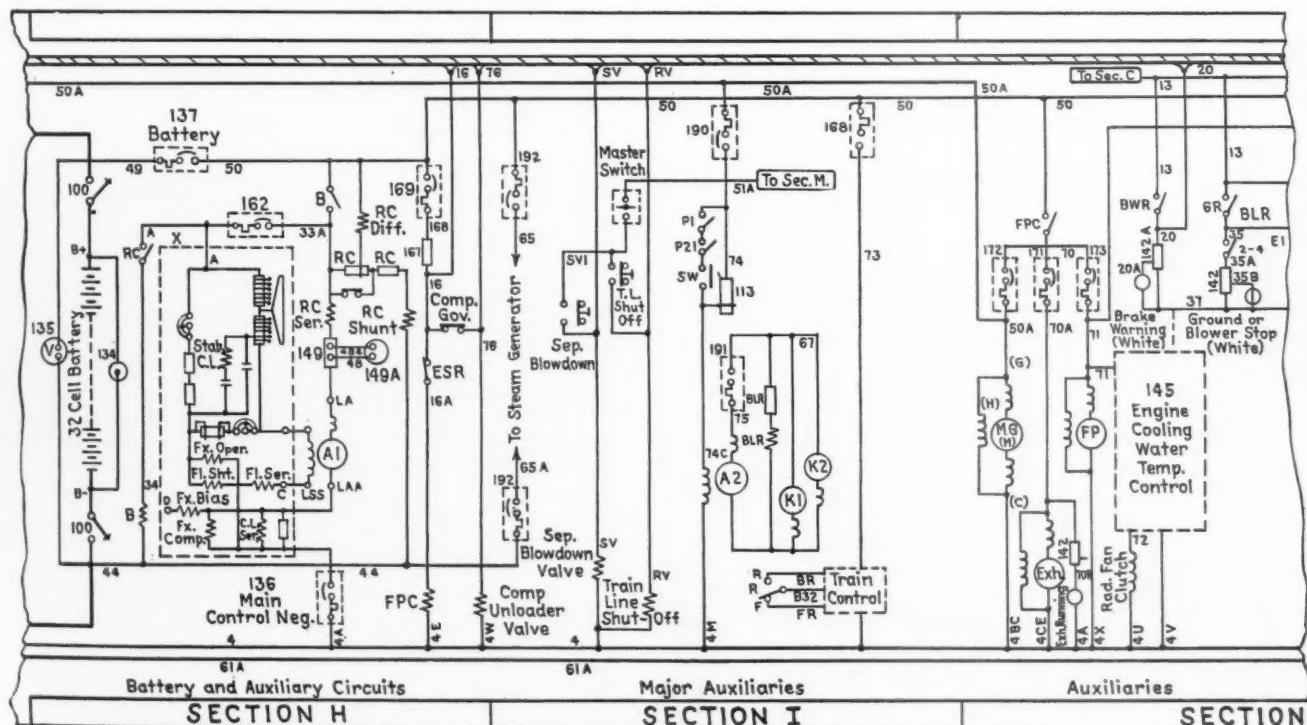


Fig. 4—Section from a schematic diagram including circuits discussed in this article

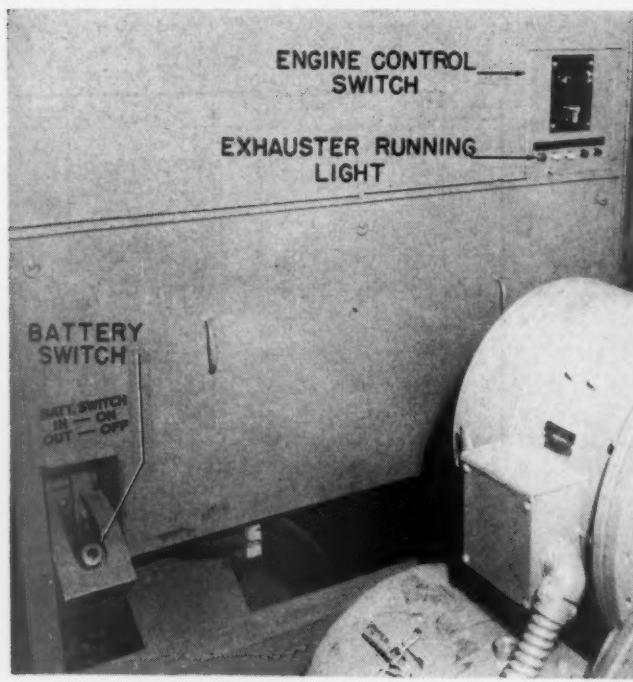


Fig. 6—Switches located on the control compartment in the engine room

circuit. Then so much current flows that it is likely to burn up the wires unless there is a fuse or some other kind of overload protection.

When you want to study any circuit on a locomotive, make a sketch like Fig. 3 from the wiring diagram. It makes the circuit much easier to understand. When a switch is closed, or a relay or contactor picks up, mark it on your sketch. Then you won't have to try to remember whether it is closed or not.

Now let's look at a few circuits you use many times. In your work you may want to —

1. Check the batteries or have battery power available.
2. Start the engine and run it at idle speed.
3. Speed the engine up without moving the locomotive.
4. Start the engine up and move the locomotive.

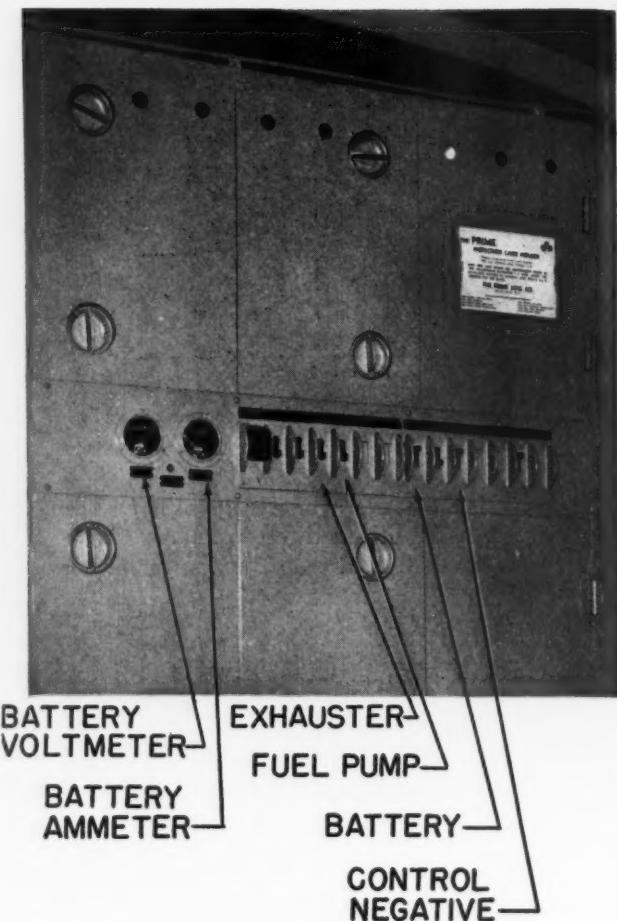


Fig. 7—Circuit breakers and meters on the bulkhead back of the engineer in the operating cab

In this article we will show how to set up these circuits.

Look at Fig. 4 for a minute. You will see that it is part of a schematic wiring diagram. It shows the battery and some of the auxiliary battery circuits. Your diagram may be different; but, like highway maps, if you learn to read one, you can read them all.

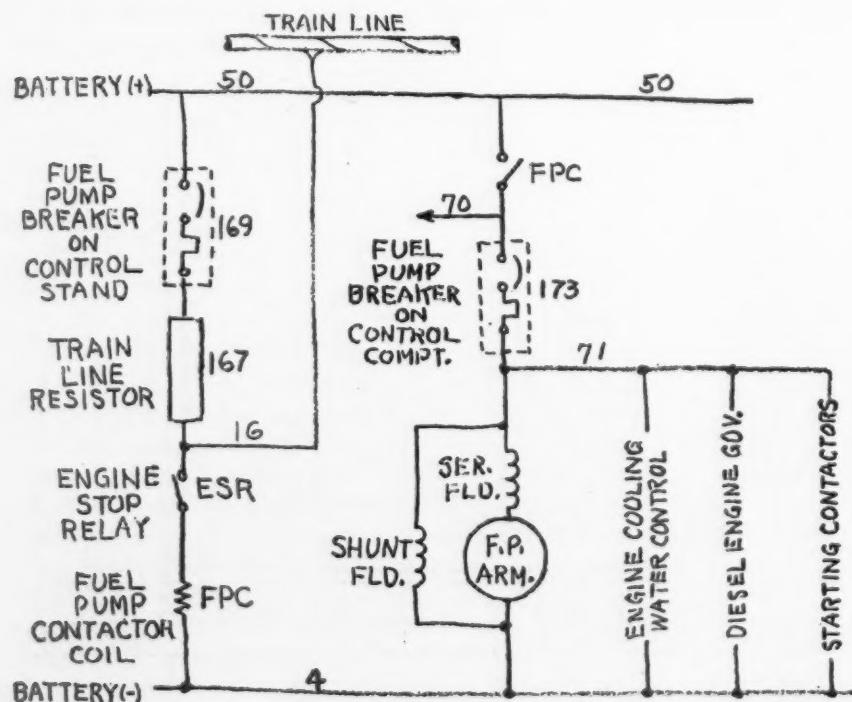


Fig. 8—Sketch of fuel pump motor circuit taken from the schematic diagram



Fig. 9 (above)—Circuit breakers located on engineer's control stand

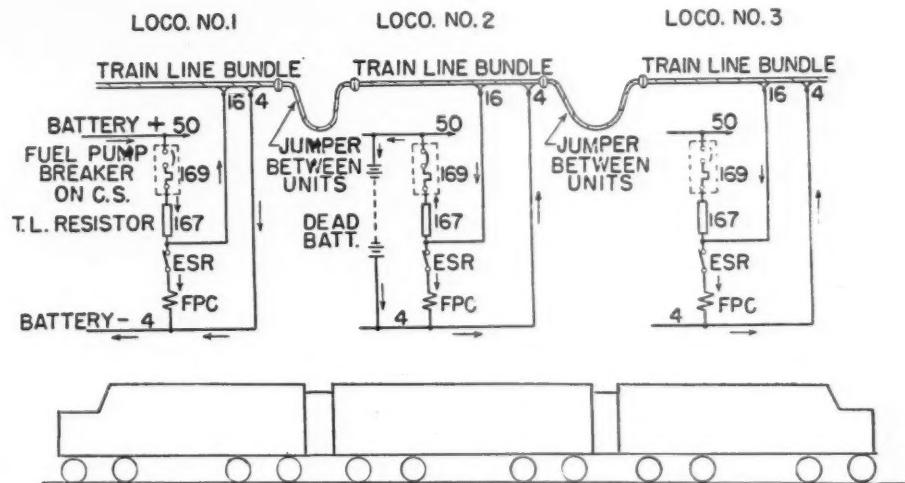


Fig. 10 (right) — Train line wires transfer control circuits from one cab to another

Let's take a look at Fig. 5. It is a sketch of the circuits used to get battery power on the locomotive. All parts that are not used to do this have been omitted. This simplifies the circuits and makes them easy to understand.

The battery is the source of electricity when the engine is not running. It supplies power for lighting the locomotive, operating the control devices and starting the engine. It is a 32-cell, 64-volt lead-acid type battery like the one in your car. Being of higher voltage, it has more cells than your car battery. The sketch shows the battery switch open, so the battery is not connected to any circuit. You can check this by glancing at the battery voltmeter on the control compartment panel. It reads zero when the battery switch is open.

Closing the battery switch connects the battery to the control circuits. This is a two-blade knife switch, Fig. 6. One blade connects the positive terminal of the battery

to the positive control wire. The other blade connects the negative terminal to the negative control wire. This switch is operated by hand and takes a pretty good push to close it. When you close the switch, the battery voltmeter will show battery voltage. If the battery is charged this will be about 64 volts. If the battery is dead, the voltage will drop rapidly as you put load on it. This reading will give you some idea of the condition of the battery.

Leaving the positive blade of the battery switch, we come to the battery circuit breaker. It is located on the control compartment bulkhead in the operator's cab, Fig. 7. Its job is to disconnect the battery from the whole works. This breaker looks and works like an ordinary wall switch, but it also has an automatic trip which works when too much charging current flows into the battery. When this breaker is closed, the 50 wire becomes the battery positive or hot wire.

Now let's go back and start from the negative side of the battery. First we go through the negative blade of the battery switch, and then to the main control negative circuit breaker. It is also located on the control compartment bulkhead in the operating cab. Current returning from all the control devices on the locomotive (except the steam generator) flows through this breaker. When you turn it off, or when it trips because of an overload, it kills all of the control circuits.

When the battery switch and the control negative cir-

cuit breaker are closed, the 4 wire becomes the battery negative. Now everything is set for the current to flow from the 50 wire to the 4 wire. All it needs is a path.

Battery Charging Circuit

There is a battery charging generator on the locomotive that does the same job as your automobile generator. It supplies power for charging the battery and for the battery circuits when the engine is running. The locomotive battery generator is shown in Fig. 5. It is connected across the battery by the battery contactor *B*. This contactor picks up when the voltage of the generator becomes greater than the battery voltage. (How this is done, and how the generator is regulated to give correct charging voltage will be explained in a later article.) When the engine is running and the *B* contactor is picked up, the battery voltmeter will show the charging voltage.

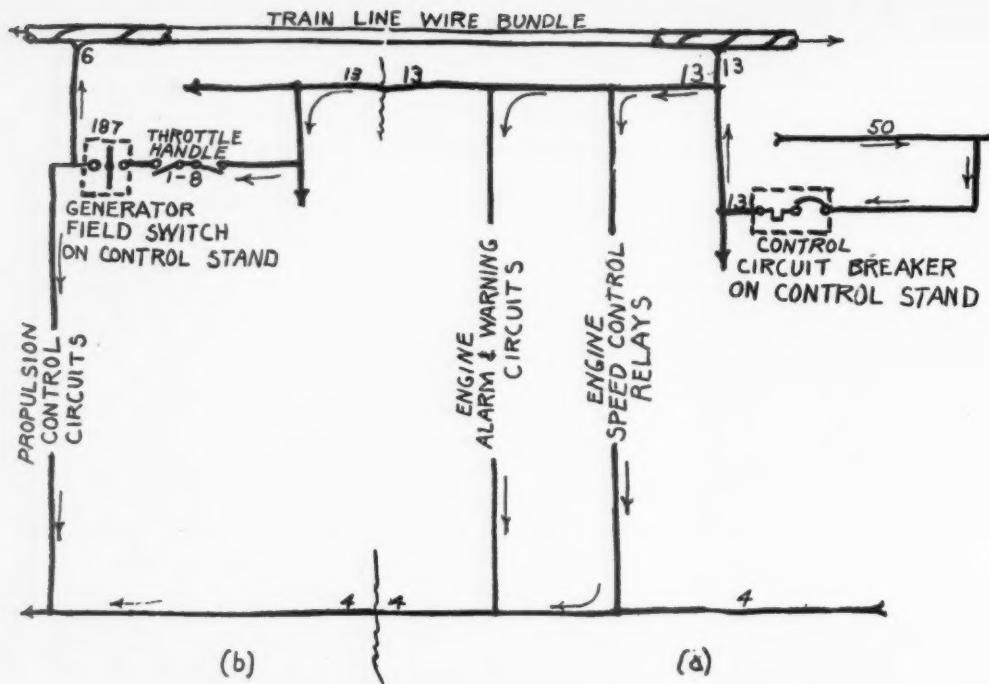


Fig. 11—Sketch from schematic diagram showing engine control circuits

Between the battery generator and the battery contactor you see an ammeter and its shunt. This combination is used in any circuit where there are large currents. In this circuit, the current may go as high as 200 amperes, but the shunt carries most of it. Since only a small part goes through the meter, it can be made small and light. The meter scale, however, is marked so that it shows the total current flowing in the circuit.

Engine Starting Circuit

The second thing you may want to do is start the diesel engine and run it at idle speed. If we sketch the circuits to do this they will look like Fig. 8. Part of this circuit has already been discussed in connection with Fig. 3.

Before going into further details, we want to say a word about the use of symbols in diagrams. Contacts, coils and interlocks of a particular device are drawn in the circuit where they operate. For example, the coil of the fuel pump contactor, Fig. 8, is shown in one place and its contacts in another. Both are marked *FPC*. Wherever you see these letters beside a symbol you will know that it is a part of the fuel pump contactor. Numbers are sometimes used instead of letters. All of these letters and numbers are explained in the Apparatus Table on the schematic diagram. This table tells you where the apparatus is located, both in the locomotive and on the diagram.

Now let's get back to Fig. 8. As you see, both circuits run from the 50 wire (battery positive) down to the 4 wire (battery negative). In the left-hand circuit you see the fuel pump breaker. It is located on the engineer's control stand, Fig. 9. If you close it, current will flow from the 50 wire down through the breaker, the 167 train line resistor, the engine stop relay contact, and the fuel pump contactor coil to the 4 wire. This makes the fuel pump contactor pick up.

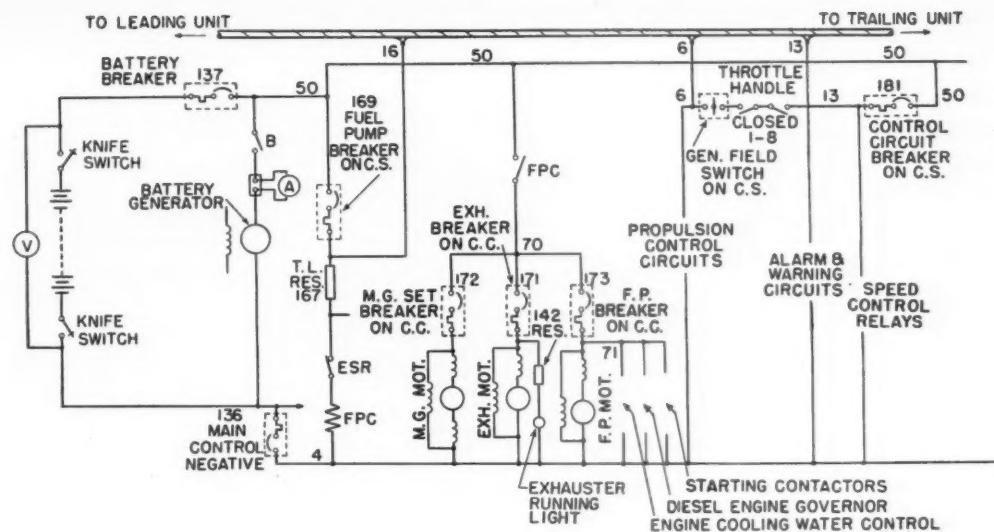
In the right-hand circuit you see the fuel pump contactor contact. This closes when the contactor picks up. If you trace the circuit from the 50 wire down through these contacts, you come to the fuel pump breaker. It is

located on the bulkhead with the battery and control breakers. When you turn this on you complete the circuit, and current will flow from the 50 wire down to the fuel pump motor. At this point it divides and follows two paths. Part goes through the series field and armature of the fuel pump motor to the 4 wire. The rest goes through the shunt field of the motor to the 4 wire. This will cause the motor to start and come up to speed. Now the fuel pump is running. In actual practice the fuel pump breaker on the bulkhead is closed first, and then the one on the control stand.

Go back to the fuel pump contactor coil circuit for a minute. Below the 167 resistor, you will see a wire numbered 16. If you trace this you will find it goes up into the train line bundle. By means of train line jumpers (Fig. 10), the wires in this bundle are carried through to all the cabs in a multiple-unit locomotive. The 4 wire also goes into the train line bundle. This means that when you close the fuel pump breaker on the control stand in any locomotive unit, the fuel pump contactors on all units in the locomotive will close. Such a circuit is called a train line circuit. All train line switches are located on the engineer's control stand. In normal operation, only those in the leading cab are used. The 167 resistor limits the current that can flow from the 50 wire out through the 16 wire. This prevents burning up the 16 train wire if something goes wrong. For example, the fuel pump breaker on the control stand of another unit with dead batteries might be closed. As you see from Fig. 10, current flowing into the 16 train line wire from the leading unit would come into the 50 wire of the unit with dead batteries. This would cause too heavy a current to flow if it were not for the 167 resistor.

In case of emergency, it may be necessary to shut down the engines on all units of a locomotive. The engineer can do this by pushing the engine stop button on his control stand. This picks up the engine stop relays on all units. Among other things this shuts down all the fuel pumps, thus cutting off the fuel supply to the engines. You can see how this happens from Fig. 8. There is an

Fig. 12—Circuit diagram, based on schematic diagram, omitting circuits not discussed in this article



engine stop relay contact, *ESR*, in the fuel pump contactor coil circuit. When the relay picks up, this contact opens. This cuts off current from the coil, and the fuel pump contactor drops out. Its contacts open the fuel pump motor circuit and stop the pump.

The fuel pump breaker in the motor circuit (Fig. 8) opens if an overload develops in this circuit for any reason. If this breaker trips, or you turn it off, the fuel pump on that unit only will stop. For this reason, it is called a local circuit in contrast to the train line circuit we have just learned about. Local circuit switches generally include all except those on the engineer's control stand.

If you find that the fuel pump on one unit is not working, check the circuit and breaker on that unit. If none of the fuel pumps are working, check the breaker on the control stand in the operating cab and the train lines.

Just below the breaker in the fuel pump motor circuit, (Fig. 8), you will see a wire marked 71. This goes to the engine starting contactor coils, the governor, and the engine cooling water control panel. This means that you cannot crank the engine until you have set up the circuits to run it. The throttle, however, is still dead, so you cannot run the engine above idle speed.

Another wire, marked 70, goes off just above the breaker in the fuel pump motor circuit, Fig. 8. This feeds the crankcase exhauster motor and the motor of the 400-cycle set. The complete circuit is shown in Fig. 12. Circuit breakers 171, 172 and 173 provide overcurrent protection. You will note that there is a light connected across the exhauster motor armature. This light is on the engine control panel and burns when the exhauster is running. It should be on before you crank the engine.

Now you have used your electrical map to solve your second problem. It has shown you how the fuel pump breakers and their circuits make it possible for you to start the engine and run it at idle speed. In a later article we will see how you actually start the engine.

Circuits for Speeding Up the Engine

The third thing you may want to do is speed the engine up after you have it running. To do this, close the control circuit breaker on the control stand in the operating cab. A look at Fig. 11 (a) shows that this connects the 50 wire to the 13 wire. The 13 wire gives you voltage for operating the engine speed control relays, and the

engine alarm and warning circuits. (We will consider details of these circuits in a later article.) Note that the 13 wire goes into the train line bundle and feeds current to these circuits on the other units of the locomotive. The speed control relays juggle the engine governor circuits to vary the engine speed as you move the throttle. The alarm and warning circuits protect the engine against low lubricating oil pressure or overheating, either of which would damage it at the higher speeds. So, you cannot speed up the engine until you have set up the circuits for controlling and protecting it.

Circuits for Moving the Locomotive

The fourth thing that you may want to do is move the locomotive. You cannot do this until you get main generator power on the traction motors. Contactors and relays are used to make the necessary connections. Now we will find out how to get battery power to operate these contactors and relays.

First, you will have to close the generator field switch on the control stand. Then you will have to throw the reverse handle and move the throttle out of the idle position. Now you have a voltage source for operating the contactors that connect up the main generator excitation circuits. You also have voltage for operating the contactors which connect the main generator to the traction motors. (Details of these circuits will be given later.)

By referring to Fig. 11, (b), you can see what happens in the control circuits. When you move the throttle into the first notch the two switches under the throttle handle close. The 1-8 means that these switches will be closed whenever the throttle is in notches 1 through 8. This connects the 13 wire to the generator field switch. When you close this switch, current can flow from the 13 wire to the 6 wire. The 6 wire feeds the propulsion control circuits on that locomotive unit. It also goes into the train line bundle and feeds the same circuits on the other units. That is why the engineer can control several units from one cab.

The circuits we have talked about are fitted together in Fig. 12. Any circuit can be taken apart, and built up in the same way. Once you do that with a circuit, you will know how it works. With this knowledge you can shoot trouble quickly and accurately by simply isolating the circuit and following it through step by step.



One of the six gas turbine electric locomotives now in service on the Union Pacific between Ogden, Utah, and Green River, Wyo. The road just ordered 15 more of the power units from the General Electric Company which, with the four locomotives yet to be delivered of the original order for 10, will increase the U.P.'s roster of this type of motive power to 25 units



Fig. 1—Two shop-made stands and a positioner used to facilitate axle generator maintenance

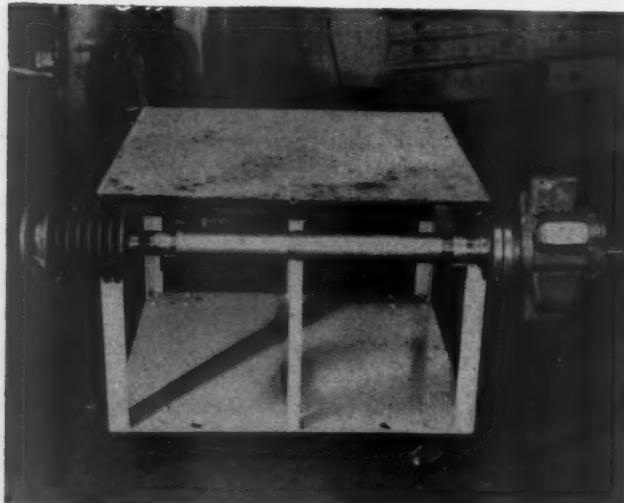


Fig. 2—Portable work stand with a Pullman speed-control shaft on side bracket arms. This arrangement leaves the top of the stand free

Work Stands for Large Axle Generators

The Union Pacific has devised handling equipment at its Portland, Oregon, shops which effectively facilitates maintenance work done on General Electric 25/30-kw. and Safety 15-kw. axle generators. The device shown in the center in Fig. 1 is a positioning stand for complete generators or generator frames. The base is fabricated from steel angles and the vertical side members are channels braced from the base by triangular plates. On each channel there is a circular steel plate. There are similar plates on the generator support or jig. A one-inch bolt through the center of each pair of plates permits the inner plates, on which the generator is mounted, to rotate.

The generator is secured to the inner plates by lugs having holes drilled in them to accommodate the generator mounting brackets. Bolts through small bolt holes

near the edges of the plates, secure the inner plates in any one of four positions to permit work being done on the generator in either horizontal or vertical positions.

When an armature is removed from the frame, it is supported in an upright position, resting on its ventilating fan on the stand shown at the right in Fig. 1. Here it is in position for work on bearings and for cleaning and painting.

The portable table shown at the left in Fig. 1 and also in Fig. 2 provides means for working on motor stators, on shafts and rotors and for doing other general work. Sliding arms may be extended from the side to hold small armatures or Pullman speed control equipment as shown in Fig. 2. The arms are adjustable both for length and lateral position.

of interpole traction motors supplied to us in 40 cars by one manufacturer. On 20 of these cars, one motor out of four developed a condition of flat spots on the commutator consisting of three flat bars, and then three normal bars, alternately, all around the commutator. This condition broke up the brushes, but the motors operated without flashovers. This condition was corrected by turning the commutators. It was discovered, after four weeks of operation that each of these motors had a reversed interpole field coil, but even this condition did not cause a flashover.

We also have air compressors on our equipment, some of which are driven by 6.35-hp. and some by 11-hp. motors. The 6.35-hp. machines are single-commutator motors, with two field coils and two salient poles, or four pole motors without interpoles. Both 6.35- and 11-hp. motors start across the line against a cut-in pressure of 90 lb. and cut out at 110 lb. Line voltage varies from 500 to 1,600, after these motors had been in service for two to three years, and commutator wear had developed to a point that required attention. Bar-to-bar tests showed that some had as many as three crossed coils and they operated without flashing over. These conditions were corrected and, in the process, a jig was made to check brushholder spacing. It was found that in some cases, the spacing was from 5 to 7 bars wide, making it necessary to cut out a section of the brushholder support casting to bring the spacing to 90 deg.

During the years of my work on electric railways, I've upped original voltage as much as twenty per cent, on heavily loaded motors without any increased flashovers. Upon taking over the maintenance on one line, I found one car so connected that when field tap switches operated, they cut out 60 per cent instead of the required 40 per cent of the field coils. The car certainly traveled, but there was no increase in flashover rate.

We have flashovers, and practically all are traced to track joint conditions. Motormen are usually able to locate the rough spot and until the condition is corrected, they shut off power at those locations. Of course, we also have the flashovers due to open-circuited armature windings, and to grounded field coils. Occasionally, a flashover is caused by lightning, but such happenings are quite rare.

Until recently we operated three motor generators in our substations. The generators are rated 667 amp. at 1,500 volts, and over a period of 26 years, we have not suffered a single commutator flashover. These are shunt wound machines with pole face compensating winding, equipped with three collector rings connected into the armature winding. These rings have a short circuiting switch, or flashover suppressor, and even though the d.c. panel has been damaged by lightning, no flashovers have occurred. The armatures still have their original windings and commutators are in excellent condition showing very little wear, although operated 24 hr. a day during the last world war, and an average of 22 hr. a day from the time of their installation in 1921. Now, one 1,000 kw. Ignitron rectifier handles the load which, at times, reaches 4,000 hp. and all these stations are fully automatic.

W. A. ERNST
Master Mechanic
Lake Erie & Northern Ry.
Preston, Ont., Can.

CONSULTING DEPARTMENT

Flashovers

Causes of flashes and means of preventing them were discussed in a report presented before the meeting of the Locomotive Maintenance Officers Association, held in Chicago, Sept. 15-17. The report was published in the October 1952 issue of Railway Mechanical and Electrical Engineer, now Railway Locomotives and Cars. In the following, one of our readers calls attention to an omission.

Most Prolific Cause Omitted

On page 87, of your October 1952 issue, is an article, "Flashovers—Causes and Remedies". In this article, the most prolific cause of flashovers is not mentioned, and many of the causes which are mentioned are minor to one who has spent 48 years in electric railway maintenance work. Cars and locomotives on our railroad must operate on voltages which vary from 500 to 1,650 between trolley and ground. This creates a much more difficult problem than that of the insulated power circuits on diesel locomotives.

The cause I do not see mentioned is the bouncing of brushes on the commutator due to rough track conditions. With existing conditions on many steam roads operating diesel locomotives, I do not wonder that they have flashovers. While riding behind in the coaches, I have often felt buck transmitted through the train by a motor armature flashover, shortly after passing over a very rough track joint. These, in many cases, also resulted in generator flashovers.

Brushes only need to be separated from .005 to .010 in. from the commutator and there will be a real arc over between brushholders. On a rail-return line, the arc will also take the shortest path from the brushholder to the case, causing blistering on the ends of commutator bars, and the lower outside edge of the brush box. On diesel equipment, the arc usually goes to the commutator risers before it goes to the next brushholder.

It has been my experience that traction motors can operate under surprisingly bad conditions without having flashovers. During the first world war, we had a number

NEW DEVICES



Semi-Portable Degreaser

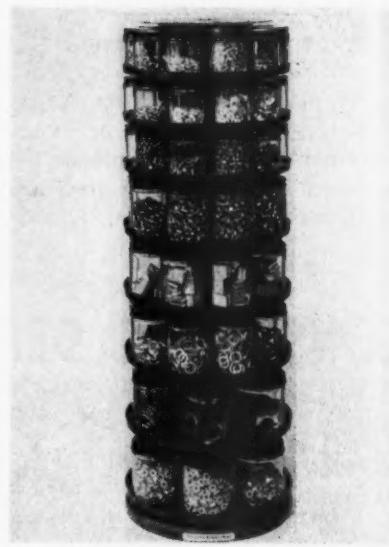
This compact unit is designed to clean small and medium sized parts and is suited for railroad shops and small manufacturing plants where production up to 600 lb.

of steel per hour must be degreased.

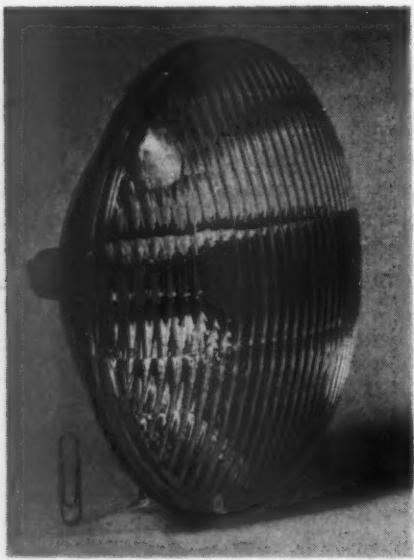
Two standard, manually operated models of the series VS Jr, made by Detrex Corporation, Detroit 32, are available. One is electrically heated, the other operates by steam. Both units may be relocated at any time in various work areas where service facilities are available.

When the device is operated, parts are suspended in pure solvent vapor which rapidly dissolves soils of dirt and grease. A spray of hot solvent quickly flushes away any loose, stubborn soils which might remain. Finally, a rinse in pure solvent vapor leaves the work thoroughly clean and dry.

All work may be placed in baskets or on racks or hooks for quick, easy handling. Work may be carried in and out of the degreaser either by hand or a small hoist. The equipment is 48 in. from the top to the base, affording a convenient working height. Its interior is coated with Detrex FF-1, a non-porous coating which is completely corrosion-proof and unaffected by degreasing solvents.



Three models are available, an 8 tray, a 5 tray and a 3 tray. These are equipped with 16, 8, and 4 oz. jars. The stand and trays are finished in shop green enamel.



300-Watt Sealed-Beam Floodlamp

The development of a new 300-watt PAR-56 flood lamp of the all-glass sealed-beam type has been announced by General Electric's Lamp Division, Nela Park, Cleveland. The lamp is a companion to the spotlight lamp of the same size and type introduced by G. E. in 1950.

Described as a precision lamp, its smooth, medium-spread beam is accurately designed on the principle of the automobile head-lamp. Prisms in the seven-in. lens cause a sharp cut-off of the beam, reducing spill light to a minimum.

The flood lamp is designed to fill many of the outdoor lighting needs for service stations, parking lots, building floodlighting and protective lighting. It is also suited to such interior applications as show windows, displays, and exhibits.

When used outdoors a housing should be used to protect the bulb from rain or snow. The lamp has a base of the mogul end-prong type. Designed for use in any burning position, it has a life rating of 2,000 hr. It is being made available initially in units which manufacturers of lighting equipment are producing for its use. It will become available later for renewals through regular channels of distribution.



Parts Storage Rotary Stand

This device should fill a need in maintenance and industrial areas not presently served by other equipment. It is a rotating storage unit designed to simplify the storage and handling of small spare parts such as nuts, bolts, rings, gears, bearings, etc.

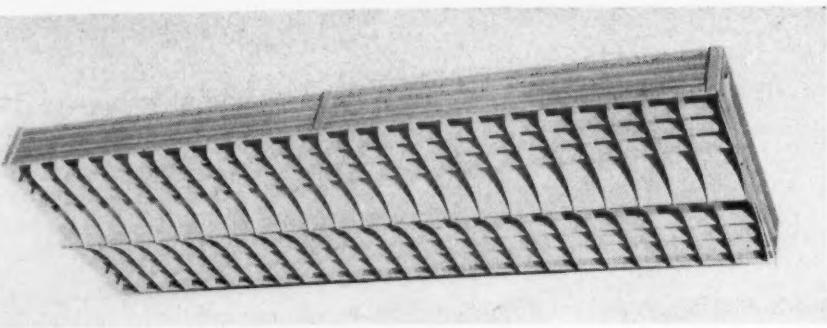
Announced by The Union Metal Manufacturing Company, Canton, Ohio, the unit is marketed under the name Vu-O-Matic Rotary Stand. It consists of a series of circular trays accommodating glass jars of various sizes. The stand on which these trays are assembled consists of a base, thrust bearing, mast, and top cover. The complete assembly revolves as a single unit on ball bearings. Jars are easily removed but cannot tip or fall.

400-Cycle Generator

The Geator Corporation, Electric Products Division, of Arlington, Va., has announced an improved Nobrush 400-cycle electric generator. Brushes are made unnecessary by a permanent magnet construction. The manufacturer states that the machines are not damaged by moisture or overload or short-circuits, that they have long life, require little maintenance, and do not cause radio interference.

Units are furnished for belt drive or for mounting on driving motors or engines. Complete motor-generator or engine-generator sets are available.

The generator is adapted for portable power units, for mounting in marine craft or vehicles, or for operation of high frequency portable power tools. Outputs range from 250 va. to 25 kva. Usual voltages, single or three phase are provided.



Shallow Surface Luminaires

A shallow surface luminaire, type SC, $3\frac{1}{16}$ in. deep, is now being made by the Westinghouse Electric Corporation. Available in 4-, 6-, or 8-ft. lengths, and 2 and 4 lamp widths, the luminaire can be used with a variety of slimline and standard fluorescent lamps. It is designed primarily for low ceiling areas. It may be mounted in rows or individually.

Translucent side panels eliminate the sharp contrast between bright luminaires and dark ceilings by emitting some light

toward the ceiling. The hinge-down louvers provide 35 deg. shielding both crosswise and endwise. It employs the new lead-lag ballast.

Ease of installation has been provided by a louver which hinges on both sides and by knockouts provided for off-ceiling mounting. Maintenance is made easier by the hinge-down louver and ballast location. The plastic side panels are easily dropped out for cleaning.

Although the luminaire has been designed primarily for low ceiling areas, it can be suspended in higher ceiling areas where a shallow suspended system will add to the attractiveness of the interior.



Four Unit Variable Speed Drive

Four components make up a new variable speed drive announced by the Dodge Manufacturing Corporation, Mishawaka, Ind. They include a variable pitch motor sheave; a set of belts; a companion sheave and a slide motor base. The drive is said to be compact and the sheaves occupy a minimum space on the shaft.

Pitch diameter and cylinder speeds can be changed by means of a one-point adjustment. This adjusting screw may be located at either end of the sheave.

Belts have deep side walls and transverse ribs provide greater lateral rigidity. They are oil proof, heat resistant and static conducting.

The companion sheave is held to its shaft by means of a taper-lock bushing. The slide base permits changes in center distances to preserve proper belt tension as the variable pitch sheave is adjusted, for different speeds.

Class B Insulation

Irv-O-Bestos, a class B insulation consisting of Mylar polyester film bonded to Quinterra asbestos papers in duplex and triplex combinations, has been announced by the Irvington Varnish and Insulator Company, Irvington, New Jersey.

This insulation has high tensile and tear strength, and also exceptional dielectric strength as well. The .003-in. duplex construction has a dielectric strength of 1,900 volts per mil with $\frac{1}{4}$ -in. electrodes, and 1,500 volts per mil with 2-in. electrodes.

Suggested applications for this material are motor and dry-type transformer insulation, coil and relay insulation, sheet insulation and primary cable insulation.

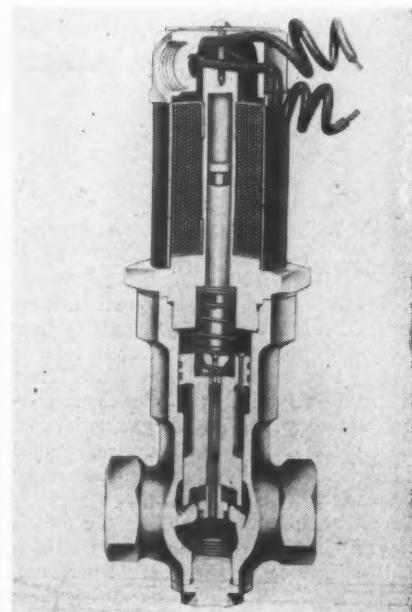
High Strength Copper Base Alloy

Telnec, a new copper-base alloy has been made available by the Chase Brass & Copper Co., subsidiary of Kennecott Copper Corporation, Waterbury 20, Conn. Said to have application in the railroad industry, its typical uses include forgings and screw-machine parts requiring high strength, hardenability, extensive machining, cor-

rosion resistance and high electrical conductivity.

This product contains controlled amounts of tellurium, nickel and phosphorus and can be readily hot pressed or hot forged. It is normally supplied with hard drawn temper or forging temper. Other special tempers to meet unusual requirements can be specified.

Tool forms for machining the alloy are similar to those used for free-cutting brass, but the use of carbide tips is recommended. It can be supplied as round rods $\frac{1}{8}$ to $1\frac{1}{4}$ in. in dia., or as hexagonal rods measuring $3\frac{1}{16}$ to $1\frac{1}{4}$ in. across flats.

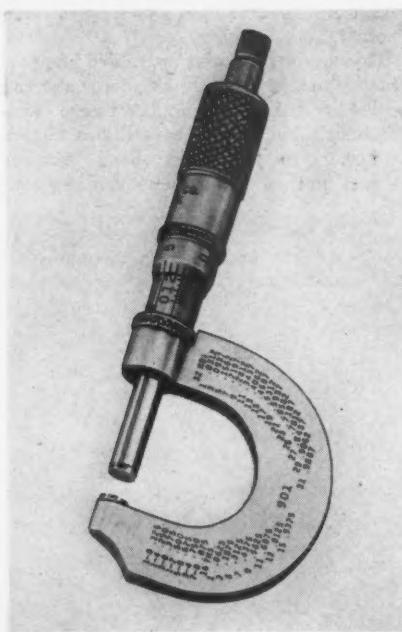


Solenoid Valves

Electric Solenoid valves made by the Atomatic Valve Company, Indianapolis, Ind., have been improved by the addition of adjustable timing on the closing stroke. The valves are made for pressures up to 3,000 lb. per sq. in. and the adjustable timing is available for pressures up to 300 lb. per sq. in.

The valve is opened by energizing the solenoid. This lifts the plunger and opens the pilot valve at the base of the plunger. Since this escape orifice is larger than the timing screw orifice, shown as a small drill hole at the right of the pilot valve, pressure on the lower side of the piston which operates the valve is greater, and the line pressure opens the valve.

The valve is closed by deenergizing the solenoid. When this is done, the plunger drops and closes the escape orifice. Pressure then equalizes above and below the piston through the timing orifice. The spring returns the piston to the closed position, and line pressure holds the valve closed. Time for closing is usually about 30 seconds. By further restricting the orifice, the time can be extended. On the Type BP valve, this adjustment may be made externally. The delayed closing feature eliminates shock on supply lines. The valves are made in sizes from $\frac{1}{4}$ in. to 3 in.

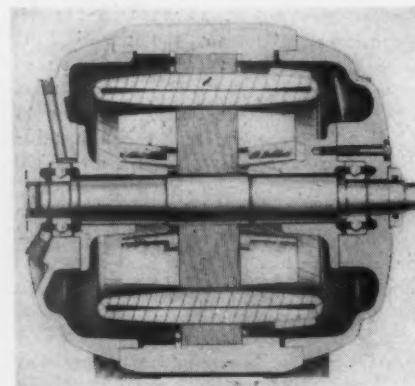


Chrome Plated Micrometer

A new metal finish called Lustro Chrome which is hard and non-peeling has been applied to micrometers manufactured by George Scheer Co., Inc., New York 12.

This finish protects the micrometer from rust and discoloration. All graduations on the tool are kept sharp and clear against the dull chrome background, making reading easier, even in poor light.

Another feature available in the unit is tungsten-carbide tipped anvils, which is said to increase its life span 82 per cent. A new bonding method for securing these tips is utilized.



Explosion-Proof Motors

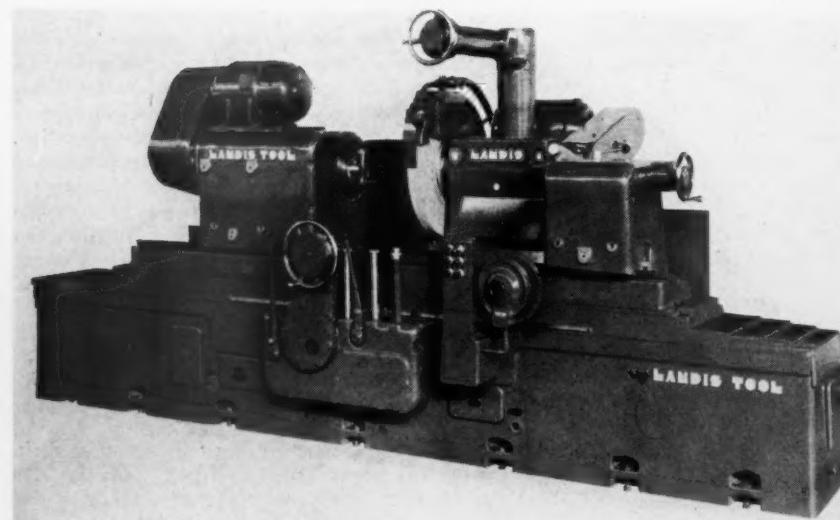
A totally-enclosed motor has been developed by U. S. Electrical Motors Inc., designated as TYPE SS. It is designed for services where dampness, dust, fire hazards and corrosive fumes are prevalent. Because of its construction it is self-cooling. This eliminates the use of an exterior fan and heat-dissipating fins. The smooth exterior greatly lends itself to wiping off or hosing down—an important feature for motors to be used in dusty and dirty locations. It is also provided with a slinger to protect the

output shaft bearing against the entrance of dirt or water. The motor is also available in Types SES, and has been approved for explosion-proof service in hazardous locations by the Underwriters' Laboratories, Inc.

There sometimes occurs in totally-enclosed motors a moisture condensation caused by breathing of a motor under certain conditions. This can cause grounding of the motor. To overcome this problem, the motors are fitted with a drain plug which will release water from the interior

while still retaining its explosion-proof characteristics.

The motors are available in a range from $\frac{1}{8}$ to 2 hp. (also fan-cooled to 75 hp.) and will later be produced in larger ratings. Complying to N.E.M.A. standards, Types SS and SES have sealed terminal chambers, normalized castings, asbestos-protected windings, solid centricast rotor, and Lubri-flush bearings which provide an extra large lubricant chamber and provision for forcing the grease through the bearings for a thorough purge of the old grease.



Heavy Duty Plain Grinder

Plain grinders for large diameter work, identified as the type CHW, and available in 30, 36 and 48 in. dia. swings with lengths between centers of 48, 72, 96 and 120 in. have been developed by the Landis Tool Company, Waynesboro, Pa.

A 10 or 15 hp. motor is used to drive the 30 in. grinding wheel. Selection of the size drive motor depends on type of work to be ground. Variable speed headstock

drive is standard but constant speed is available.

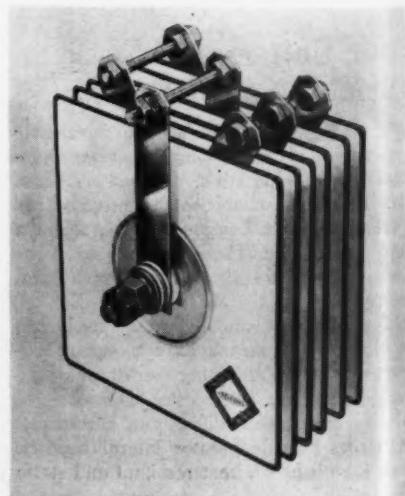
Carriage ways have increased spacing to provide stability when grinding large diameter items. The hydraulic table traverse is adjustable to any desired speed between 3 and 130 in. per min. Swivel table may be adjusted to grind tapered work.

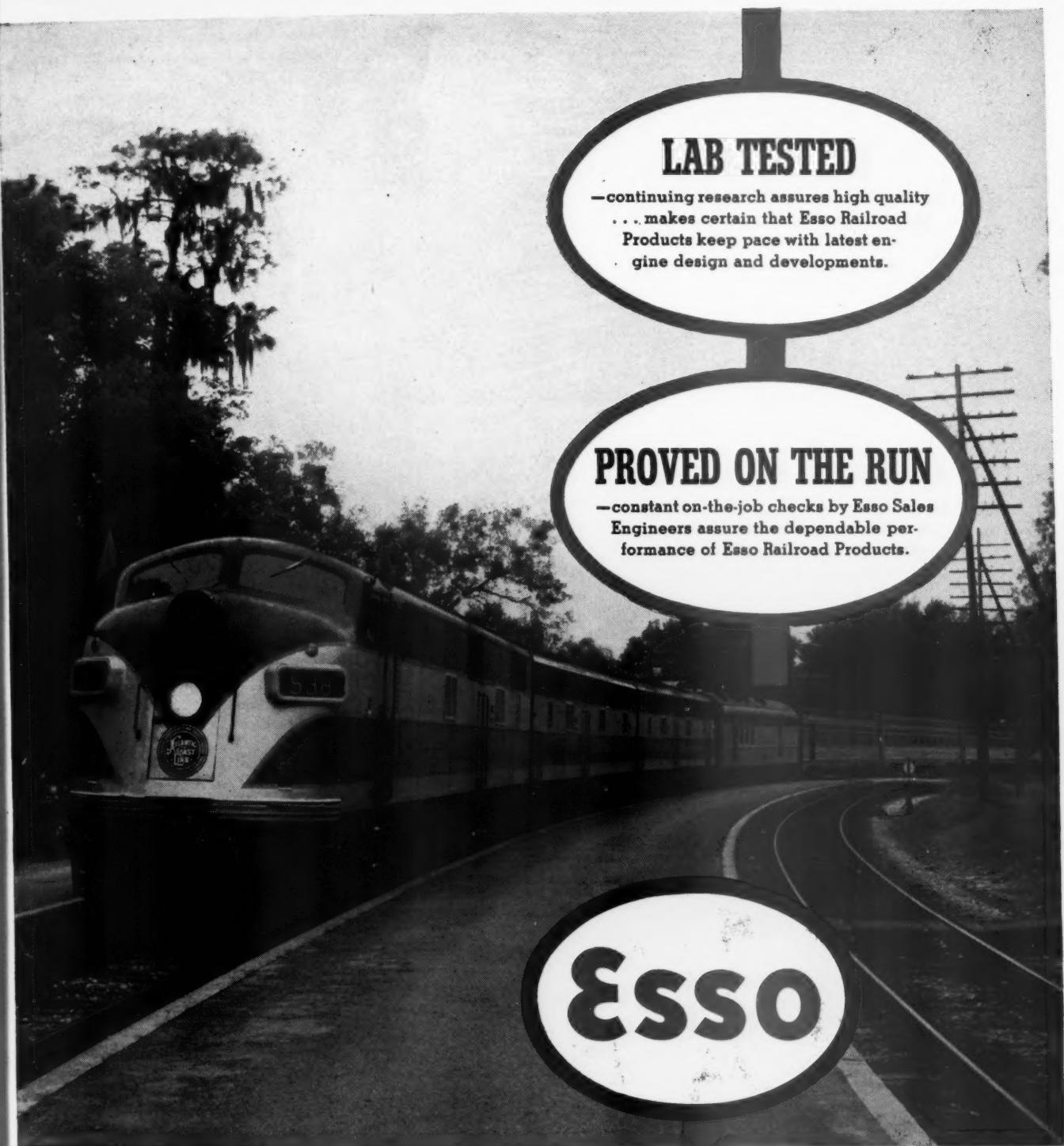
Eye level wheel feed is used for adjustment of wheel head position. This enables the operator to watch grinding action from the same position from which he adjusts the wheel.

Selenium Rectifiers

A complete line of selenium rectifiers for all railroad applications is being marketed by Bogue Railway Equipment Division, Paterson, N. J. Known as Belcon rectifiers, they possess high forward-to-reverse current characteristics with low forward-voltage drop. They are available in 13-cell sizes ranging from 1 in. x 1 in. to 6 in. x 6 in., and in combinations for handling current from a few milliamperes to a thousand amperes. The stacks are available for replacement purposes or in the form of power units for battery charging, welding, telegraphy and signaling applications. Where extremely good voltage or current regulation is required, the rectifier power units are available with magnetic amplifier regulators.

(Turn to page 94)





LAB TESTED

—continuing research assures high quality
... makes certain that Esso Railroad
Products keep pace with latest en-
gine design and developments.

PROVED ON THE RUN

—constant on-the-job checks by Esso Sales
Engineers assure the dependable per-
formance of Esso Railroad Products.

ESSO

ESSO DIESEL LUBRICATING OIL

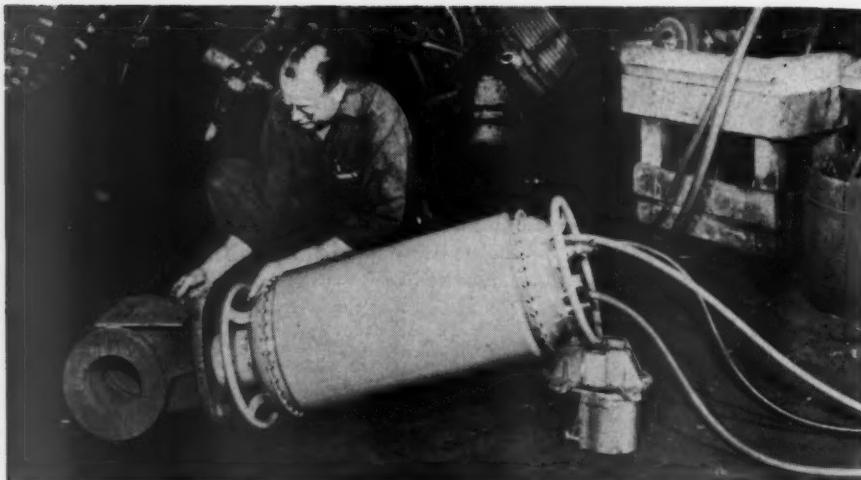
A high-quality lubricant for real protection — Esso DIOL RD is a diesel locomotive lubricating oil especially developed to railroad specifications. Produced only after years of field testing and research by engine designers and Esso scientists. Call on Esso for any fuel or lubricating problem.

ANOTHER
DEPENDABLE
ESSO
RAILROAD
PRODUCT

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., Penn., Del., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. — Memphis, Tenn. — New Orleans, La.





Midget X-Ray Machine

A midget-type industrial 250,000-volt x-ray machine, less than half the size and less than $\frac{1}{6}$ th the weight of the conventional quarter-million-volt unit, has been developed by the General Electric Company, 4855 Electric Avenue, Milwaukee 14, Wis. It is capable of x-raying steel up to $3\frac{1}{2}$ in. in thickness and can be carried around in shops and yards, where x-ray inspections are needed to control both quality and safety.

The unit is less than 15 in. in diameter, 44 in. long, and weighs 150 lb.

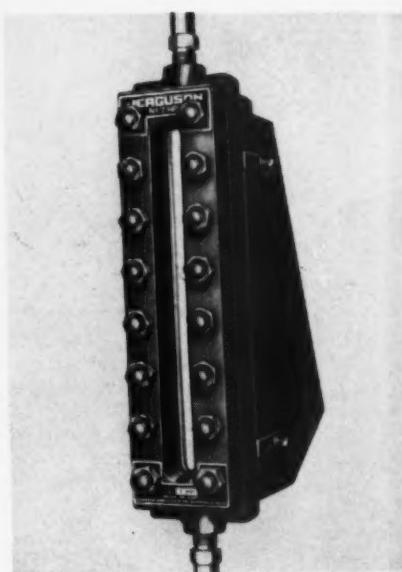
A feature of the unit's versatility is its protruding snout from which the x-rays are emitted, which makes possible the taking of inside-out x-ray pictures. This,

it is expected, will greatly speed up the process and reduce problems now faced in making x-rays.

In setting up for the inspection of a weld joint connecting two sections of a pipe, for example, the x-ray technician can bring the x-ray unit inside the pipe and change its position for each exposure area without disturbing the pipe. He can also use it inside large castings and other areas difficult of access, or insert the snout inside a smaller casting.

Operating at anywhere from 75,000 to 50,000 volts, the new unit can be used on anything from magnesium to steel. Use of the machine on light metals is also aided by the beryllium window of the x-ray tube, which allows the escape of softer, less penetrating x-rays from the tube.

Thompson 4-pole, 4-wire, 3-way disconnecting and lower hanger, it can be lowered to floor quickly and easily for servicing of the luminaires. This type of installation also makes possible the use of either combination circuits with individual control of each light or combination mercury vapor-incandescent luminaires. The cluster also can be used with 2-pole hangers for applications involving incandescent lights connected in parallel.

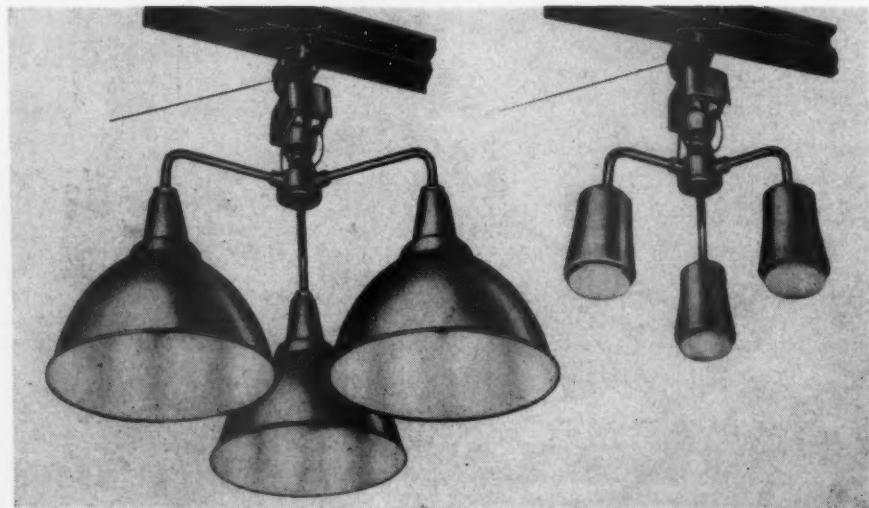


Steam Gage Illuminator

Instant and accurate gage readings of boiler water level, through dust particles in the air or deposits on the gage glass and in poorly lighted areas have been claimed for the Mercury Vapor Illuminator, product of Jerguson Gage & Valve Co., Somerville, Mass.

A gage equipped with the illuminator, shows a blue-green water column topped with a brilliant emerald green spot indication at the water level. This device consists of a mercury vapor bulb in a steel housing, and a ballast box equipped for mounting at any spot. The illuminator can be clipped to the gage cover with two sets of brackets.

It is furnished in weatherproof construction suitable for outdoor use and is made in sizes to fit standard gage sizes. It is also available with a 100 watt incandescent bulb for use on low pressure steam service gages.



Lighting Cluster Lowering Suspension

The Thompson Electric Company, Cleveland, has announced the availability of a new lightweight 3-lamp cluster suspension unit, designed for use with reflector lamp assemblies as well as conventional luminaires. Designated AL-8700, this suspension device will support three luminaires weighing up to 10 lb. each. It is particularly suitable for application in industrial build-

ings. It provides for increased lighting capacity without requiring installation of additional outlets.

The unit is of all-aluminum construction. Three $\frac{1}{2}$ -in. pipe-size tubes are used to support the fixtures. These tubes, threaded at fixture connection end, are slip-fit and securely locked by means of set screws in side hubs spaced 120 deg. apart on the junction box. The top hub of the junction box has a $\frac{3}{4}$ -in. female pipe thread connection and locking set screw.

When used in conjunction with the

Brush for Diesel-Electric Traction Motors

A new traction motor brush grade for Electro-Motive Division diesel-electric locomotives has been announced by National Carbon Company, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd street, New York 17. The new Na-

(Continued on page 120)

How to make packings last longer

Tips by Johns-Manville Engineers to help you keep equipment running.



The right packing
in the right place
lasts longer,
seals better



**... and this new chart makes it easy to choose
the right J-M Packings for your requirements**

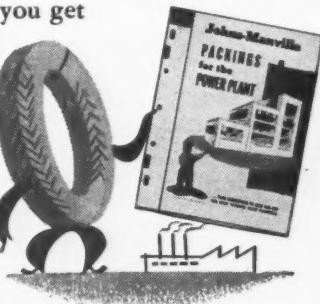


THIS handy 6-page Johns-Manville packings guide, simplifies your selection and application problems on packings. Covering 32 of our most popular styles, it tells at a glance what J-M packings to use . . . why they are recommended . . . and how to install them.

Its schematic diagram is spot-keyed to help you locate packing styles for various services. Its group-headings help you select J-M packings for centrifugal and rotary services, reciprocating rods and plungers, valve stems, pipe flanges, manholes and handholes . . . to seal against steam, air, oil and water etc. . . . to with-

stand various temperatures and pressures. Its condensed packing descriptions give you essential ordering information . . . and there is a page devoted to tips on proper installation to help you get maximum economy and efficiency from your Johns-Manville packings.

We will be glad to send you a copy of this handy packing selector. Write Johns-Manville, Box 60, New York 16, N. Y.



The logo for Johns-Manville products. It features the company name "JOHNS-MANVILLE" in a bold, sans-serif font at the top. Below it is a large, stylized "JM" monogram. Underneath the monogram, the word "PRODUCTS" is written in a smaller, all-caps, sans-serif font.

Johns-Manville PACKINGS & GASKETS

NEWS

New Deadlines Established For AB Brake Installations

THE Interstate Commerce Commission has given railroads and other car owners more time to complete installation of AB brakes on freight cars used in interchange service.

The December 31, 1952, deadline was postponed six months for all except tank cars. The latter received a nine-month postponement.

After next June 30, regular interchange of unequipped freight cars is prohibited. Such cars can be moved only if they are routed to owners. Freedom to move cars homeward ends October 1, 1953.

Tank cars received more time. Movement of unequipped cars in interchange service is prohibited after October 1, 1953. These cars can be routed to owners up to January 1, 1954.

Dr. Harvey N. Davis Dies

Dr. Harvey N. Davis, who retired as president of the Stevens Institute of Technology in Hoboken in 1951, died on December 3. Dr. Davis became head of the Institute in 1928 and was president of the American Society of Mechanical Engineers in 1938. In 1943 he headed a mission to London to coordinate British and American research and production. Soon afterward he was the fourth American to be named an honorary member of the British Institution of Mechanical Engineers.

Dr. Davis was a graduate of Brown University. He later taught there and at Harvard University, and as a mechanical engineer held positions with the General Electric Company, the Franklin Railway Supply Company, and the Air Reduction Company.

A.S.M.E. Railroad Division Installs New Officers

At the annual meeting of the American Society of Mechanical Engineers, Railroad Division, in New York, December 2 to 4, the following were elected members of the Executive Committee for the ensuing year: G. W. Bohannon, chairman, general manager, Pullman Company; E. M. Van Winkle, vice-president, American Steel Foundries; C. K. Steins, mechanical engineer, Pennsylvania; J. S. Newton, vice-president, engineering, Baldwin-Lima-Hamilton Corporation; A. G. Hoppe, mechanical engineer, Chicago, Milwaukee, St. Paul & Pacific, and E. L. Woodward, secretary, western mechanical editor, *Railway Age*.

General Committee members: F. L. Murphy, assistant vice-president, sales, Pullman Standard Car Manufacturing Company, and B. W. Taylor, sales engineer, General Steel Castings Corporation, whose terms expired in 1952, were re-elected to

membership on the committee. Two new members are: F. K. Mitchell, manager of equipment, New York Central and W. M. Keller, director of research, A. A. R. Mechanical Division. Mr. Van Winkle was appointed chairman of the Program Committee; M. M. Cooleidge, eastern sales representative, Buckeye Steel Castings Company, was appointed chairman of the Membership Committee; and T. F. Perkinson, manager, Transportation Engineering Division, General Electric Company, continued as chairman of the committee on Progress in Railway Mechanical Engineering.

At the Railroad Division luncheon on December 4, presided over by Chairman C. B. Bryant, chief engineer, Technical Board, Wrought Steel Wheel Industry, an

engraved gavel was presented to the division by E. H. Davidson, a member of the Executive Committee who recently retired as director of the Interstate Commerce Commission, Bureau of Locomotive Inspection, Washington, D. C. The gavel was made of wood from the cupola of the Baltimore & Ohio Camden Station at Baltimore which was erected in 1856.

Pennsylvania Improvement Program

A NEW \$47,000,000 program of freight-service improvements, one of the largest of its kind ever undertaken by the Pennsylvania, has been announced by Walter S. Franklin, president. The largest single seg-

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE DECEMBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of Units	Horse-Power	Service	Builder
Bessemer & Lake Erie	4A	1,500	Road	Electro-Motive
	4B	1,500	Road	Electro-Motive
	5	1,500	Six-motor road switch	Electro-Motive
Chesapeake & Ohio	16 ¹	1,500	General purpose	Electro-Motive
Clinchfield	5 ²	1,500	General purpose	Electro-Motive
Delaware, Lackawanna & Western	9 ³	1,500	Freight	Electro-Motive
Monongahela	10 ⁴	2,400		Fairbanks, Morse
Spokane, Portland & Seattle	7 ⁴	1,200	Switching	Baldwin-Lima-Hamilton
Wabash	4 ⁵	1,600	Road switch	Alco-GE
	4 ⁶	1,500	Passenger	Electro-Motive
	4A ⁶	1,500	Freight	Electro-Motive
	2 ⁶	2,250	Passenger	Electro-Motive
	5 ⁶	1,500	Road switch	Electro-Motive
	3 ⁶	1,200	Switch	Electro-Motive
	5 ⁶	800	Switch	Electro-Motive
	3 ⁶	1,000	Switch	Alco-G. E.
	3 ⁶	1,200	Switch	Baldwin-Lima-Hamilton
	2 ⁶	1,200	Switch	Fairbanks, Morse
	2A ⁶	1,500	Freight	General Motors Diesel Ltd.

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Gulf, Mobile & Ohio	100 ⁷	Pulpwood	Company shops
Lehigh & New England	100	70-ton covered hoppers	Pullman-Standard

FREIGHT-CAR INQUIRIES

Road	No. of cars
Southern Pacific	2,000 ⁸

PASSENGER-CAR ORDERS

Road	No. of cars	Type of cars	Builder
Baltimore & Ohio	3 ⁹	Rail diesel	Budd Co.
	11 ¹⁰	Sleeping	Budd Co.

¹ Estimated cost \$2,661,920. Delivery is expected during January and February.
² Estimated cost \$2,310,331. To have been delivered in December.
³ "Train Master" units
⁴ For multiple-unit operation. Estimated cost \$725,500. Delivery expected this month.
⁵ Estimated cost of Alco-G.E. units \$605,340; of Electro-Motive units, \$710,500. Delivery scheduled for February.

⁶ Four of the five Electro-Motive 1,500 road switchers to be equipped with steam generators for passenger service. Deliveries of all locomotives expected during the first quarter of this year.
⁷ Purchase authorized by board of directors. Approximate cost \$600,000.

⁸ To include mostly gondolas and open and covered hopper cars.
⁹ Delivery of the rail diesel cars expected early this year. Delivery of the sleeping cars, each of which will have 16 duplex-type roomettes and four double bedrooms, expected late in 1953.

NOTES:

Missouri Pacific.—The Missouri Pacific has received authorization to purchase 64 additional diesel units for its 1953 equipment program. The cost is expected to be \$9,812,000.

Northern Pacific.—The Northern Pacific's budget for new equipment and improvements during 1953 totals nearly \$23 million. About 60 per cent of this will go for new passenger and freight cars—including the 10 dome coaches six dome sleepers and other new cars announced early in the November issue, plus 200 70-ton ore cars and 500 refrigerator cars. The passenger equipment will cost approximately \$6,150,000 and the freight equipment about \$7 million. Eight diesel locomotives—four switchers and four road switchers already on order—add another \$1 million to the total. Additions and improvements to shop, station and other facilities will cost about \$2 million. Among the projects are additions and improvements to the diesel shop at St. Paul, Minn. The 200 ore cars are to be constructed in company shops at Brainerd, Minn., and the 500 refrigerator cars will be purchased from commercial builders. In addition, there is a carryover from the 1952 budget of 1,000 box cars and 250 gondolas, construction of which has been delayed due to a lack of steel.



LOWEST COST PER MILE FOR:

- BRUSHES
- INSTALLATION
- MAINTENANCE

NATIONAL CARBON's DE-3 traction motor brushes have established *new* record-high standards of efficiency, dependability and economy in extensive service tests on class 1 roads throughout the country.

Many years of development have gone into this new product. *Use it . . .* and get the lowest brush cost obtainable today on EMD locomotive traction motors. Our representatives will gladly discuss with you the outstanding performance records of this new brush.

The terms "National", "Eveready", the Three Pyramids device and the Silver Colored Cable Strand are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY

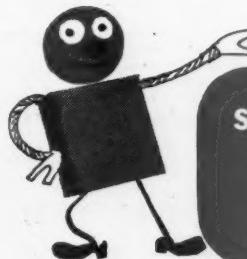
A Division of Union Carbide and Carbon Corporation

30 East 42nd Street, New York 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dallas, Kansas City,

New York, Pittsburgh, San Francisco

In Canada: National Carbon Limited, Montreal, Toronto, Winnipeg



**STOP LOOKING...START SAVING
WITH "NATIONAL" GRADE
DE-3 BRUSHES!**

ment of the project, designed to provide faster freight schedules, better service to defense industries, increased capacity, and savings to the PRR through greater efficiency in operations and in car repairs, will be new freight classification yards and installations for servicing through freight trains at Conway, Pa. Little of present yard facilities will be retained at Conway except part of the enginehouse, which will be adapted to serve both diesel and steam locomotives.

Another project included in the program will be the construction by the Pennsylvania of what, it is said, will be the largest and most modern freight car repair shop in the country, at Hollidaysburg, Pa., eight miles south of Altoona. It will be operated as part of the road's Altoona Works, and will be known as the Samuel Rea Shop, in honor of Samuel Rea, ninth president of the PRR. It will turn out 50 repaired cars a day, utilizing most modern methods to speed work. The new shop will cost approximately \$12,000,000, Mr. Franklin said.

Preliminary work on the Samuel Rea car repair shop has begun and is expected to be completed about the middle of 1954. Up to 1,500 men will be employed and the shop will be half a mile long, 54 ft high, varying in width from 180 to 270 ft. It will have three repair lines—supported by modern fabricating, storage and materials handling facilities—running the length of the building. As freight cars move in to one end of the plant, worn and damaged parts will be scrapped or repaired for reuse. Cars will be repaired progressively, sandblasted, painted and dried by modern infrared lamps in the concluding operation. Cars entering the shop in the morning will be ready for service again the same day.

The railroad's reclamation and scrap plant now at Conway will be removed to Hollidaysburg, clearing a large area for expansion of freight operations at Conway and achieving substantial savings in handling and hauling costs by locating the reclamation work adjacent to related activities at the new shop.

Westinghouse To Build Rail-Mounted Gas Turbine

THE U.S. Army Corps of Engineers has awarded to the Westinghouse Electric Corporation a contract in excess of \$1 million for construction of a railway-mounted gas turbine power plant. Intended to be used as an advance power generation unit in devastated areas, the plant will be contained in two non-self-propelled railway cars.

The generator car will contain a 5,000-kw., 5,700-r.p.m. gas turbine designed to burn diesel oil; a geared speed-reducer to drive the generator at 3,600 r.p.m. for 60-cycle power, or at 3,000 r.p.m. for 50-cycle power, a 2,400-volt a.c. generator; the generator exciter, and a starting motor for the gas turbine.

The other car, known as the transformer-control car, will house a multi-voltage transformer, with output ranging from 2,400 volts to 15,000 volts; high- and low-voltage switchgear, and two diesel-engine generators for auxiliary power, one of which will supply the starting motor.

The cars will be subcontracted to the

Puget Sound Bridge & Dredging Co. of Seattle, where apparatus will be installed and tested.

Miscellaneous Publications

REFERENCE MANUAL FOR INSTALLATION AND SERVICE OF ENGINE TEMPERATURE CONTROLS FOR DIESEL LOCOMOTIVES. Publication SA 1976; 108 pages, illustrated. Published by Minneapolis-Honeywell Regulator Company, 2753 Fourth avenue South, Minneapolis 8. Gives most complete data ever distributed by a controls manufacturer to customers, according to Charles Sanders, manager, Transportation Division. Contains specifications and instructions for the operation, installation, testing and adjusting, and the maintenance and repair of pneumatic temperature controllers, actuators, relays and switches, and miscellaneous air-pressure

gages, relief valves, reducing valves, filters, shutters and fittings, etc., for diesel locomotives. Diagrams show in detail construction of the various controls, their over-all dimensions, connections, hook-ups, etc. A parts list, alphabetically keyed and numbered, completes each section of the manual.

APPLICATIONS OF METALLIZING. R. J. McWaters, Metallizing Engineering Co., 38-14 30th street, Long Island City 1, N. Y. A new 16 mm. sound film in full color, recently completed, describes the metallizing process and shows a wide range of practical applications as reported by many users throughout industry. Every scene in the film is taken in the plant of a metallizing user. Maintenance departments are shown metallizing worn or damaged machine parts of many different

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of August		8 months ended with August	
		1952	1951	1952	1951
3	Road locomotive miles (000) (M-211):				
3-05	Total steam.....	16,679	24,643	137,607	204,981
3-06	Total, Diesel-electric.....	28,242	23,960	213,782	175,186
3-07	Total, electric.....	735	810	6,036	6,539
3-04	Total, locomotive-miles.....	45,715	49,414	357,637	386,728
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total.....	1,722	1,775	12,914	13,721
4-06	Empty, total.....	890	934	7,094	6,953
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains.....	30,046	44,868	242,503	355,456
6-02	Total in oil-burning steam locomotive trains.....	8,778	12,477	65,527	97,019
6-03	Total in Diesel-electric locomotive trains.....	80,652	67,348	590,801	489,124
6-04	Total in electric locomotive trains.....	2,075	2,225	16,790	17,875
6-06	Total in all trains.....	121,736	126,727	916,402	959,584
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper).....	1.03	1.04	1.03	1.04
10-02	Loaded freight car-miles.....	41.30	40.00	39.50	39.40
10-03	Empty freight car-miles.....	21.30	21.00	21.70	20.00
10-04	Total freight car-miles (excluding caboose).....	62.60	61.00	61.20	59.40
10-05	Gross ton-miles (excluding locomotive and tender).....	2,915	2,851	2,805	2,756
10-06	Net ton-miles.....	1,364	1,350	1,287	1,291
12	Net ton-miles per loaded car-mile (M-211).....	33.10	33.80	32.60	32.80
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles.....	65.90	65.50	64.50	66.40
14	Averages per train hour (M-211):				
14-01	Train miles.....	17.40	16.70	17.60	16.90
14-02	Gross ton-miles (excluding locomotive and tender).....	50,203	47,092	48,821	46,025
14-01	Serviceable.....	45.40	47.30	44.20	45.80
14-02	All.....	43.00	45.00	42.00	43.70
15	Average net ton-miles per freight car-day (M-240).....	937	996	882	949
17	Per cent of home cars of total freight cars on the line (M-240).....	44.00	38.00	44.20	37.10

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

3	Road motive-power miles (000):				
3-05	Steam.....	6,242	9,785	56,602	83,766
3-06	Diesel-electric.....	19,444	17,217	148,072	128,880
3-07	Electric.....	1,615	1,657	13,042	12,993
3-04	Total.....	27,301	28,659	217,724	225,639
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains.....	278,079	283,996	2,177,437	2,192,681
4-09	Total in coal-burning steam locomotive trains.....	31,275	51,998	291,384	438,908
4-10	Total in oil-burning steam locomotive trains.....	26,690	33,181	209,393	267,812
4-11	Total in Diesel-electric locomotive trains.....	202,238	181,027	1,532,380	1,347,777
2	Total car-miles per train-miles.....	9.95	9.75	9.79	9.56

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning.....	740	1,148	6,460	9,894
1-02	Steam, oil-burning.....	161	238	1,323	1,916
1-03	Diesel-electric ¹	3,247	3,070	24,754	23,340
1-06	Total.....	4,172	4,482	32,725	35,356
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning.....	24	41	229	385
2-02	Steam, oil-burning.....	10	13	87	104
2-03	Diesel-electric ¹	259	249	2,050	1,932
2-06	Total.....	326	337	2,633	2,688
3	Hours per yard locomotive-day:				
3-01	Steam.....	6.80	7.60	6.80	7.80
3-02	Diesel-electric.....	16.00	17.20	16.00	17.30
3-05	Serviceable.....	14.50	14.50	14.10	14.40
3-06	All locomotives (serviceable, unserviceable and stored).....	12.40	12.40	12.20	12.40
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles.....	1.68	1.75	1.75	1.78
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives).....	0.73	0.74	0.75	0.76

¹ Excludes B and trailing A units.



BACK IN THE DAYS when the North-South Railroad* started converting from steam to Diesel, its Superintendent of Motive Power called a meeting of his maintenance heads to decide what to do about handling repairs on the new locomotives.

"The big question is," he said, "can we do the whole job ourselves?"

"Hell," said one old-timer, "what's so special about Diesels? We have good experienced welders and machinists. Give them the tools and the time and you'll never know that we aren't with steam anymore."

He was right in almost every respect. It worked out just as the old-timer had predicted, but one thing stumped them. Here's the story:

When the first cracked Diesel cylinder heads came in, the shop went to work with a will to prove that they had what it took to handle them, but the repaired heads were back in the shop in no time. Even after years of experimenting with different processes, the results were always the same . . . repaired heads didn't stand up on the road.

One day the Old Man examined his records and discovered that it was costing more to repair them than it would to use brand-new heads for replacements. It looked as if using new heads was the only answer.

Before making a final decision, they decided to call in the STARK representative.

They learned how STARK had been rebuilding Diesel cylinder heads for railroads all over the country for 20 years — rebuilding them cheaper and better than the roads could do themselves. They learned about the special processes, equipment and materials that STARK had developed especially for this job . . . the specially designed STARK preheating and welding ovens that assured perfect fusion . . . the long period of trained specialization needed to properly do this welding . . . STARK's exclusive Chrome Nickel alloy (a trade secret enabling STARK to build up cracked and worn valve seats better than new).

The North-South Railroad tried STARK rebuilding . . . and they have been using STARK ever since. Their Diesel cylinder head maintenance problem was solved efficiently and economically.

You, too, can make substantial savings in your maintenance costs. Send us a trial order. Then examine and *test* the rebuilt heads. If you are not completely satisfied, there will be no charge. Or ask for the STARK representative to call. There will be no obligation.

RALPH
STARK INCORPORATED

43-12 33rd STREET, LONG ISLAND CITY 1, N.Y.

*North-South Railroad is, of course, a fictitious name. But the story told here is typical of the experience of many railroads that switched to STARK specialized rebuilding.

kinds. Users describe actual savings made possible by reduced repair costs, reduction of "down-time" spent waiting for replacements and simplification of spare part inventories. The film also pictures how thin coatings of comparatively expensive metals on ordinary base metals provide desired service characteristics at low cost. The latest methods of surface preparation are demonstrated, as well as the use of metallized aluminum and zinc for the protection of iron and steel equipment and structures against corrosion. Included among the applications for corrosion protection are storage tanks, bridges and trestles, degreasers, and other steel work. One sequence shows the Missouri-Pacific streamliner, the "Sunshine Eagle," with 85,000 sq. ft. of underframe sprayed with pure aluminum for protection against corrosion. Power capacitor cases are shown being sprayed with pure zinc, a process that has replaced paint for many years on the Westinghouse production line. The film is suitable for presentation to industrial, professional and educational groups. Running time: 28 min.

AIRCO FILMS. Air Reduction, News Bureau, 60 East 42nd street, New York 17. "Tool of Many Uses," a Kodachrome sound motion picture film, documents more than a dozen actual case histories of production line application of this newest welding process. The film includes aluminum welding operations on materials ranging from $\frac{1}{8}$ in. up to 1 in. in thickness. It also shows aluminum welds 2 in. long that required only 7 sec. to make, and aluminum build-up work in which 10 lb. of metal were deposited in an hour's welding time. Copper welding is also shown in the picture, as well as both automatic and manual welding in use on stainless and mild steel for a number of applications. Showing time: 18 min.

"Burning Blades," a three-reel Kodachrome sound motion picture, covers in detail the application of machine gas cutting to modern industry. It shows how this equipment can accurately cut intricate shapes in steel plate or slice through a 5-ft. chunk of steel scrap. Among the machines shown in operation is Airco's new No. 50 Travograph.

The oxyacetylene torch is shown at work in shipyards; in manufacturing plants cutting electronic parts, structural pieces and machinery components; and in steel mills reducing large pieces of scrap to the proper size for use in making steel. Showing time: 29 min.

AIR BRAKE INSTRUCTION BOOKLET.—Air Brake Association, 80 East Jackson boulevard, Chicago. 67-page, $4\frac{1}{2}$ -in. by 7-in. illustrated booklet, with nine diagrammatic plates, in color, and one complete piping diagram, all in folded form. \$1.25 per single copy; \$1 per copy in lots of five. Text, revised from a 1938 printing, includes all changes made since that date. Describes, in question-and-answer form air-brake construction and operation and method of trouble shooting.

SUMMARY OF MONTHLY HOT BOX REPORTS

	Foreign and system freight car mileage (total)	System	Foreign	Cars set off between division terminals account hot boxes	Miles per hot box car set off between division terminals
July, 1950.	2,745,932,894			23,957	114,619
August, 1950.	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950.	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950.	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950.	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950.	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951.	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951.	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951.	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951.	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951.	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951.	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951.	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951.	3,009,371,111	9,023	19,092	28,115	107,038
September, 1951.	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951.	3,116,490,095	4,131	9,053	13,184	236,384
November, 1951.	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951.	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952.	2,824,298,630	3,208	7,197	10,405	271,437
February, 1952.	2,809,162,671	2,723	6,473	9,196	305,477
March, 1952.	2,943,812,727	2,594	5,877	8,471	347,517
April, 1952.	2,766,313,714	3,826	7,759	11,585	238,784
May, 1952.	2,918,508,445	6,020	10,938	16,958	172,102
June, 1952.	2,672,512,889	8,466	14,495	22,961	116,394
July, 1952.	2,575,298,912	10,566	15,833	26,399	97,553
August, 1952.	2,924,917,122	11,658	17,535	29,193	100,192

SUPPLY TRADE NOTES

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY.—Railroad shopmen are being encouraged to do their own installation and servicing of diesel engine temperature control systems under a maintenance program announced by Minneapolis-Honeywell. To start the program, designed to solve the problem of "long distance" maintenance by a supplier, the company has published a 108-page manual for diesel locomotive service men. Next in cooperation with the railroads, the company will set up shop meetings for railroad maintenance men to acquaint them first hand with procedures for installation and servicing of the engine-temperature-control equipment. Honeywell engineers will then follow up with regular calls to the shops to discuss control installations on the job. The manual is described under Miscellaneous Publications on page 98 of this issue.

BALDWIN-LIMA-HAMILTON CORPORATION.—The Eddystone sales organization of the Baldwin-Lima-Hamilton has been divided functionally into two major groups—the transportation sales department and the industrial sales department. Lewis A. Hester has been appointed general sales manager, transportation department, in which capacity he will be responsible for sale of locomotives of all types, locomotive renewal parts, dump cars and other items of rail transportation equipment produced by the Eddystone and Standard Steel Works division. Andrew Liston has been appointed general sales manager, industrial department.

CUTLER-HAMMER, INC.—M. R. Brice has been appointed division manager, industrial control sales. Mr. Brice will have responsibility for the textile, locomotive, pump, compressor industries, and "Unitrol."

NEW YORK AIR BRAKE COMPANY.—Charles T. Zaoral has been elected a director and vice-president in charge of operations of the New York Air Brake Company. Lewis K. Sillcox has been elected vice-chairman of the board. Robert C. Hess has been named manager of the firm's main division at Watertown, N. Y.

CLARK EQUIPMENT COMPANY.—The Mississippi Supply Company, 80 East Jackson boulevard, Chicago, has been appointed by



R. J. Mulroney

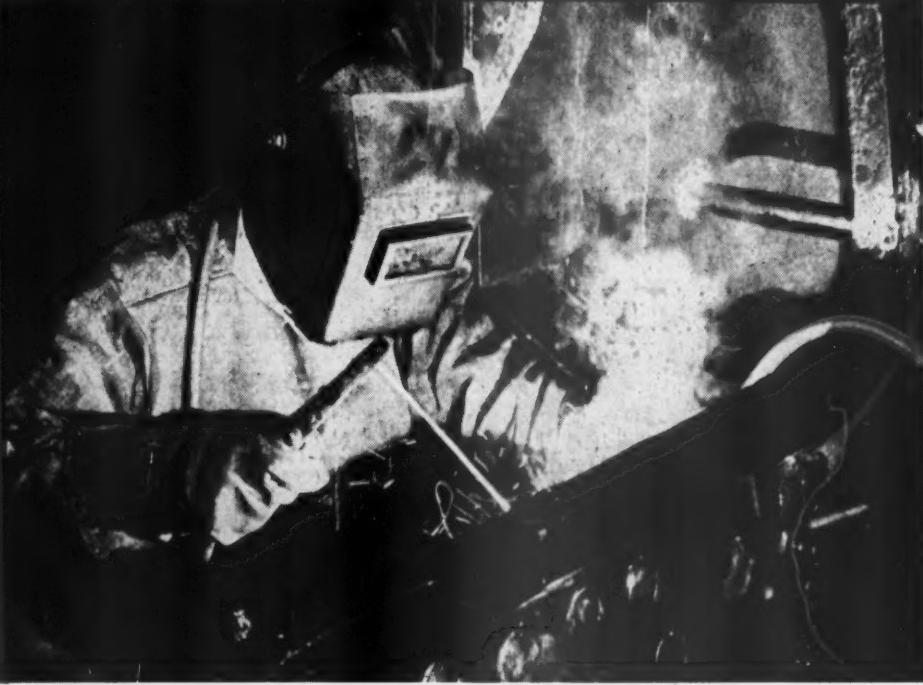
the Industrial Truck division of the Clark Equipment Company as dealer to a group of railroads with headquarters in Chicago. Richard J. Mulroney and Russell E. Long are partners in the dealership.

YOUNGSTOWN SHEET & TUBE CO.—T. C. Schraer, manager of the Cincinnati district sales office of the Youngstown Sheet & Tube Co., has been transferred to the general offices in Youngstown, Ohio, as as-

TIREX Welding Cable means More Efficiency

for
for

THREE
GOOD
REASONS



- 1 Excellent Flexibility:** TIREX Welding Cables have a single conductor composed of many hundreds of specially-twisted copper strands. The twisted copper strands give exceptional flexibility that lessens drag and wrist fatigue. TIREX Welding Cables will not snarl or kink.
- 2 Strips Clean:** Between conductor and jacket a specially selected paper separator is used to assure clean, fast stripping.
- 3 Longer-Life:** The famous neoprene armor is cured in lead. This means extra protection against tear and abrasion. TIREX Welding Cables offer excellent resistance to damage by oil, chemicals, moisture, and flame.

These are the features that can mean greater production, more finished work, and lower operating costs on all your electrical welding jobs. TIREX Welding Cables come in sizes ranging from No. 8 A.W.G. with 420 strands, to 1,000,000 C.M. with 25,270 strands. For more complete information on your specific welding problem call your nearest Simplex representative or write to us in care of the address below.

SIMPLEX-TIREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.



**IN THE LONG RUN—
The Least Expensive
... Most Effective
Mountings You Can Buy!
LORD, of course!**



The use of Lord Mountings and Bonded-Rubber Parts in every field of automotive transportation results in longer service life and greater economy of operation. And as a bonus . . . Lord Mountings improve operator and passenger comfort. Hundreds of Designers and Engineers of transportation equipment have consulted profitably with Lord Engineers for experienced and field-proved advice in isolating shock and vibration. They draw from over 27,000 Lord Vibration-Control Mountings designed to meet specific requirements.

If you manufacture any of the following transportation equipment or supply component parts or assemblies, Lord Engineering can help you:

Railway Cars and Locomotives . . . Trucks and Buses . . . Airframes and Aircraft Engines . . . Earthmoving, Farm and Road Machines . . . Air Compressors . . . Air Conditioners . . . Engine Generator Sets . . . Communication and Signal Equipment.

Lord Mountings are protecting the performance of many more transportation units.

FIELD ENGINEERING OFFICES—

BURBANK, CALIFORNIA
233 South Third Street

DALLAS, TEXAS
413 Fidelity Union
Life Building

PHILADELPHIA 7, PENNSYLVANIA
725 Widener Building

DAYTON 2, OHIO
410 West First Street

DETROIT 2, MICHIGAN
7310 Woodward Ave.

NEW YORK 16, NEW YORK
280 Madison Avenue

CHICAGO 11, ILLINOIS
520 N. Michigan Ave.

ERIE, PENNSYLVANIA
1635 West 12th Street

LORD MANUFACTURING COMPANY • ERIE, PA



**Headquarters for
VIBRATION CONTROL**

sistant manager of conduit sales, C. B. Mullender, formerly sales representative in the Cincinnati office, has been appointed manager of that office to succeed Mr. Schraer. George D. Wick, III, formerly sales representative in the Youngstown district sales office, has been transferred to Charlotte, N. C.

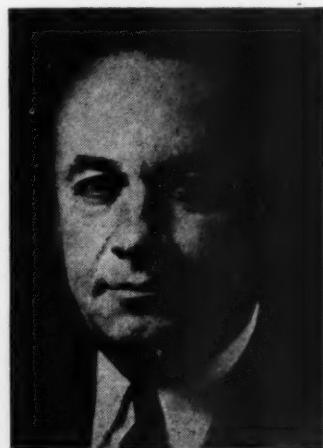
STANDARD PRESSED STEEL COMPANY.—Herbert T. Andrew has been appointed a salesman in the Detroit territory of Standard Pressed Steel which includes most of Michigan, the northwestern part of Ohio and the northern one-third of Indiana. His office will be at 944 Harper street.



H. T. Andrew

Mr. Andrew, who was formerly a buyer with the Cross Company was born in Toronto and educated at the Chrysler Technical Training School and School of Engineering. He worked for the Chrysler Corporation until 1947, when he went with Cross.

AMERICAN LOCOMOTIVE COMPANY.—Perry T. Egbert has been elected president, and William S. Morris, executive vice-president of the American Locomotive Company. Mr. Morris was previously vice-president in charge of sales for all divisions of the company.



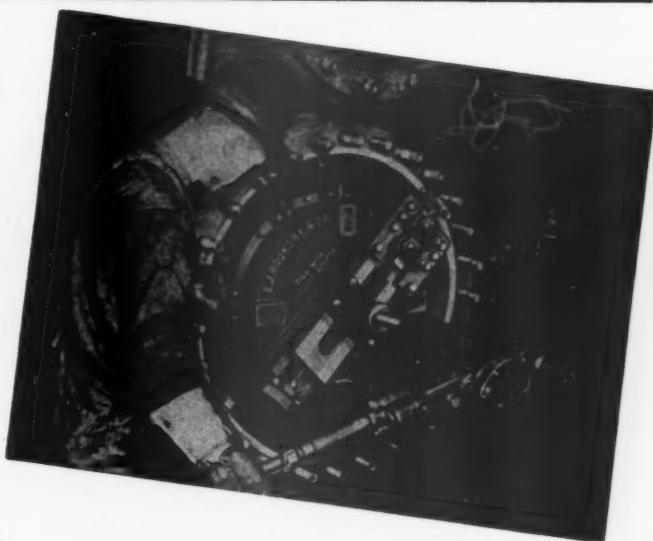
Perry T. Egbert

Mr. Egbert was born in Ithaca, N. Y., and is a graduate of Cornell University (1915) with a mechanical engineering degree. He was employed by the Lehigh Valley and Norfolk & Western and from

NO *Time Out* FOR THIS LOCOMOTIVE

The engineman spots a leaky cylinder flange joint. With a Rooksby Portable Flange Facing Machine, the joint is quickly refaced — *without removing the piston from the cylinder*. The engine leaves the roundhouse right on schedule.

Rooksby Portable Machine Tools provide a valuable, time-saving "working kit" for roundhouse or shop. They are quickly set-up and perform a variety of useful jobs accurately and dependably. These Rooksby products mean more road time for your locomotives—Cylinder Boring Bars—Valve Chamber Boring Bars—Crank Pin Turning Machines—Cylinder Flange Facing Machines.



ROOKSBY *Portable* MACHINE TOOLS

E. J. ROOKSBY & CO.

1042 Ridge Ave., Philadelphia 23, Pa.

Here's the 4-stage Separator/Filter that removes water, dirt, and air from warm (Vis. 35SSU @ 122°F) or cold (10°F) Diesel fuel . . .



SEPARATOR-FILTER-

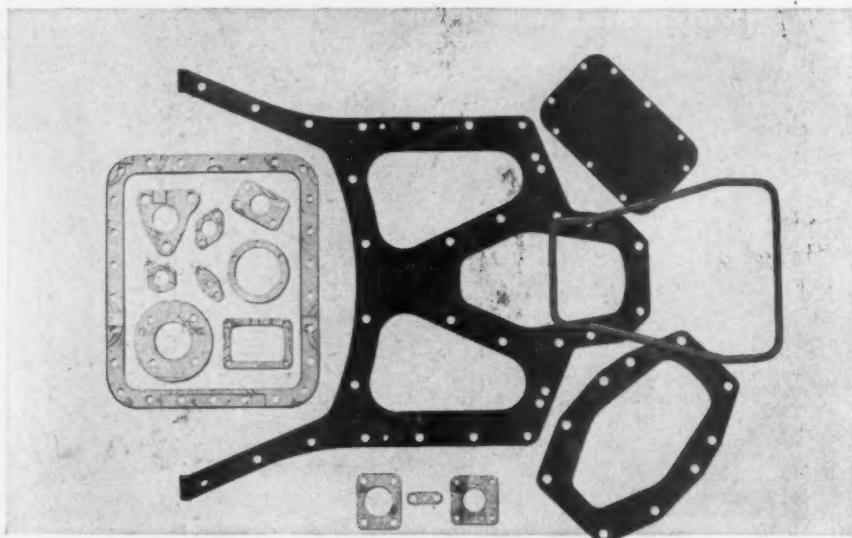
There is a vast difference between the easy job of removing warm water, dirt, and pipe scale from warm diesel fuel (Vis. 35SSU @ 122°F) compared to the almost impossible job of removing cold water, or ice crystals, from cold, viscous diesel fuel @ 10°F. The 4-stage EXCEL-SO Separator/Filter is designed to operate under these conditions, more efficiently, at less operating expense, than conventional single-stage, or two-stage filters only.

Send for Bulletin
FEQ-51 or our en-
gineers will gladly
call upon request.

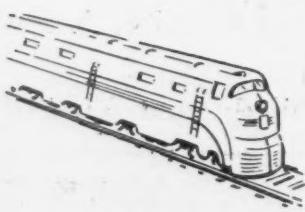
WARNER LEWIS COMPANY

BOX 3096 • TULSA, OKLAHOMA

Available from GARLOCK-



Replacement gaskets for diesel locomotives



We can furnish direct from our factories in Palmyra, New York, high quality diesel locomotive gasketings in either sheet or gasket form. Garlock gaskets are standard equipment on many diesel locomotives.

Three Garlock gasketing materials widely used on diesel locomotives are:

- | | |
|----------------------|---|
| Cork-Fibre— | For oil at cold to
medium temperatures |
| Vegetable-Fibre— | |
| Compressed Asbestos— | For hot oil and hot water |

To order gaskets for your diesel locomotives, just call your Garlock representative.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company
of Canada Ltd., Toronto, Ont.



GARLOCK
PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS.

1916 to 1919 was an aviator in the U. S. Air Corps.

Since 1920 he has served Alco in production, sales and engineering capacities. He was named vice-president in 1944 and has been in charge of Locomotive and Ordnance division operations at Auburn and Schenectady, N. Y. In 1921, Mr. Egbert was appointed Alco's technical representative in the Far East. He returned to the U. S. in 1924 and held sales and manufacturing positions. In 1929, he was placed in charge of development of a new diesel engine designed especially for railroad use and in 1934 was appointed manager of railway diesel sales for the company. Following his appointment as vice-president in 1944, Mr. Egbert took charge of Alco's conversion from steam to diesel locomotive output. He also directed engineering and production of Alco's post-war line of diesel locomotives. He has been a director of the company since 1947 and is also a director of the Montreal Locomotive Works.

GUSTIN-BACON MANUFACTURING COMPANY.—*W. E. Vergan* has been appointed special representative of the railroad department of the Gustin-Bacon Manufacturing Company, with headquarters at Kansas City, Mo. *George R. McMullen*, formerly manager of automotive sales and manager

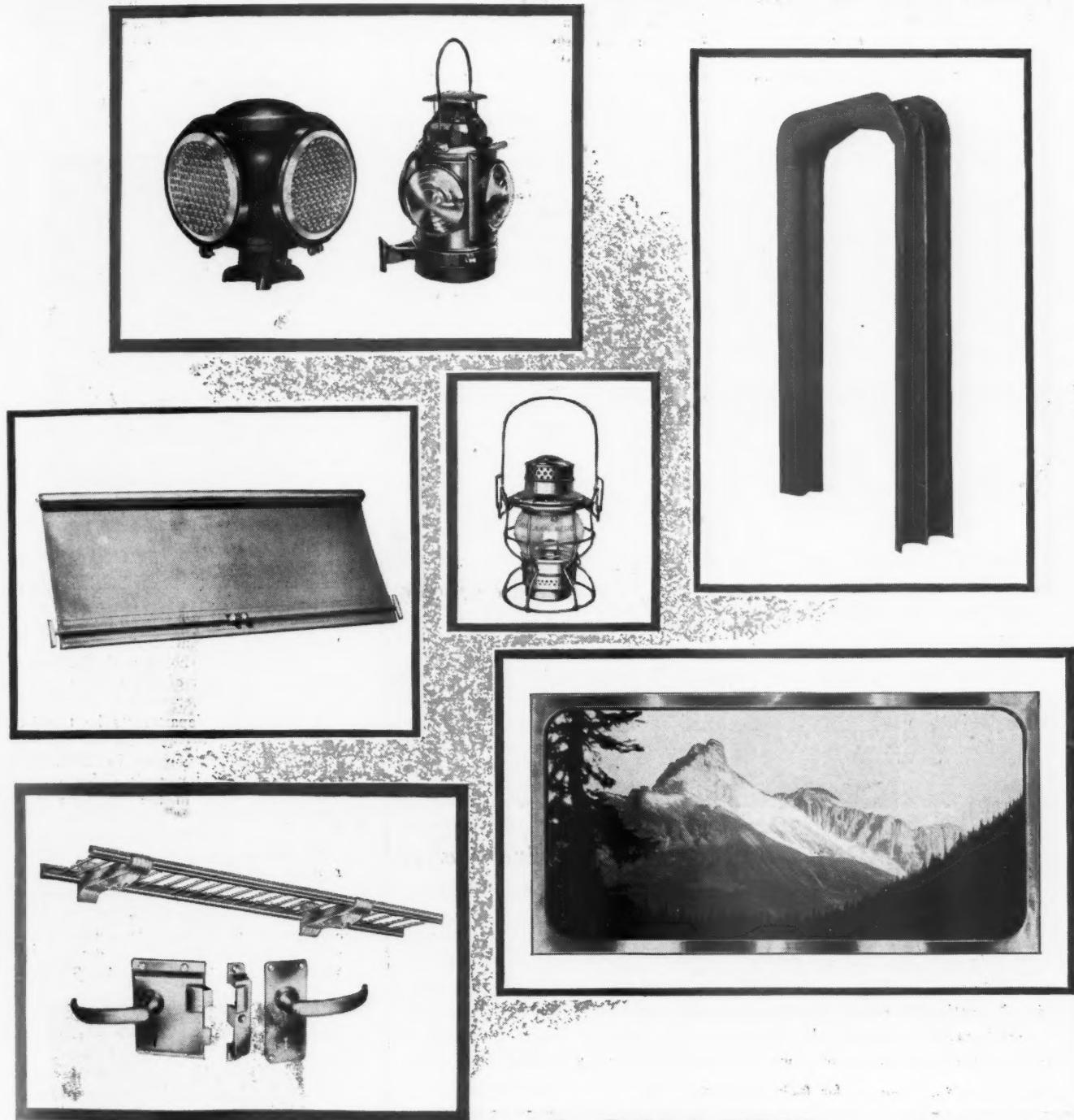


W. E. Vergan

of the transportation division of the Owens-Corning Corporation, has joined the sales department of the company. Mr. Vergan recently resigned as superintendent of air equipment and diesel operation for the Missouri-Kansas-Texas, with which road he was associated for 30 years.

BAKER-RAULANG COMPANY.—The Baker-Raulang Company has appointed *Industry Services, Inc.*, 332 South Diamond street, New Orleans, as distributor for the complete line of Baker industrial trucks and cranes in Louisiana and southern Mississippi. Complete sales engineering and service facilities will be maintained by *Industry Services*.

CHASE BRASS & COPPER CO.—*Charles A. Festge* has been appointed Milwaukee district manager for Chase Brass & Copper Co., subsidiary of Kennecott Copper Corporation. Mr. Festge will be in charge of sales in most of Wisconsin, the northern



A GALLERY OF RAILROAD SPECIALTIES BY

Windows—Double glazed "breather" or raised
Curtains—Window or vestibule

Lanterns—Oil or electric

Signal lamps—Oil or electric

Luggage racks and hardware

Diaphragms

ADLAKE

a synonym for "Integrity" in the Railway Industry



The **Adams & Westlake** Company
Established in 1857
Chicago • ELKHART, INDIANA • New York

peninsula of Michigan and Lake County, Illinois. He will also serve as supervisor of Chase Warehouse operations in Milwaukee. *Charles W. Baker*, formerly Milwaukee district manager, has been appointed western regional manager with headquarters in Los Angeles. He will supervise Chase sales operations in eleven western states.

ELECTRIC SERVICE MANUFACTURING COMPANY.—*Louis T. Barry* has returned to the Electric Service Manufacturing Company, Philadelphia, as manager of the industrial division, after 17 months' service with the United States Air Forces.

ACME STEEL COMPANY.—*Whitford A. Baldwin* has been appointed manager of the Unit-Load department of the Acme Steel Products division of the Acme Steel Company, with headquarters in Chicago. *Neil L. Anderson*, Cincinnati, Ohio, district sales manager of the Steelstrap department has been appointed manager of that department, with headquarters at Chicago.

Mr. Anderson, in his 33 years with the company, has served with the advertising department, as a sales correspondent, as a salesman in the Indianapolis territory, and as district sales manager in the Cincinnati territory.

Mr. Baldwin became associated with the

Acme Steel Company in 1929, after serving in various sales and management capacities in the lumber industry. With Acme, he has been a salesman, special representative, and acting sales manager for the central sales area. In 1950 he was appointed district sales manager at Kansas City, Mo.



Paul J. Isvolt

Paul J. Isvolt has been appointed district sales manager of the Acme Steel Company, at Cincinnati. He succeeds *Neil L. Anderson*, who recently was named manager of the Steel strap department at Chicago.

Mr. Isvolt, who holds a B. Sc. degree from the University of Notre Dame, joined Acme in 1929. After working in the cost and stockledger departments he transferred to sales as a correspondent. He was promoted to a salesman in 1937, first working in the company's Chicago sales district and later in the Michigan sales district.

AMERICAN CAR & FOUNDRY CO.—*C. A. Walmsley* has been appointed district manager in charge of the St. Louis car plant of the American Car & Foundry Co., succeeding *T. G. Shipley*, who has retired after more than 40 years of service. Mr. Walmsley, who joined ACF in 1951 as a



C. A. Walmsley

production staff specialist, formerly was works manager for a division of Dresser Industries in Marietta, Ohio, and held a similar position with the Cameron Machine Company in Brooklyn.

John E. Angst, formerly sales agent for the American Car & Foundry Co., has been

MIDGET MEGGER CIRCUIT TESTING OHMMETER measures down to 1 ohm. Has two ranges, with selections from 0 to 3 ohms up to 100 to 200,000 ohms. Battery supply.	BRIDGE-MEG RESISTANCE TESTER measures down to .01 ohm. A resistance tester combined with a Wheatstone Bridge. Hand generator operated. Available 5 ranges: 0 to 20 megohms up to 0 to 1000 megohms.	MEGGER LOW RESISTANCE OHMMETER measures down to .000010 & .000100 ohms. Two ranges, 0 to 1000 and 0 to 10,000 microhms. Either battery or rectifier-operated. Entirely contained.	DUCTER LOW RESISTANCE OHMMETER measures down to .000001 ohm. Battery or rectifier-operated. 4 or 5 ranges each instrument: 0 to 100 microhms up to 0 to 5 ohms.
Bulletin 21-85-X	Bulletin 21-60-X	Bulletin 24-46-X	Bulletin 24-25-X

These MEGGER® INSTRUMENTS give you Reliable Low Resistance Measurements

All these instruments are portable, rugged field instruments that give long, trouble-free service. They are simple to use and, of course, embody the utmost reliability that is always associated with the Megger trade name. For checking circuit continuity, measuring the resistance of switch contacts in microhms—for laboratory, production line, or out-in-field trouble-shooting—every electrical man should have one or more of these Megger instruments available.

Check and Mail Coupon for Bulletins listed above.

JAMES G. BIDDLE CO.

• ELECTRICAL TESTING INSTRUMENTS
• SPEED MEASURING INSTRUMENTS
• LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.

JAMES G. BIDDLE CO.
1316 Arch St., Philadelphia 7, Pa.

B-827-R

Please mail me

Bulletin 21-85-X

Bulletin 21-60-X Bulletin 24-46-X Bulletin 24-25-X

Name _____

Job _____

Company _____

Address _____

appointed assistant western sales manager. He will report directly to John H. Van Moss, western sales manager, with headquarters as before in Chicago.

Mr. Angst joined the company's sales staff at New York in 1945 and was transferred to Chicago in 1948.

H. K. PORTER COMPANY.—Robert S. Sweeney, has been named vice-president and general manager of the Watson-Stillman Company, the hydraulic press division of the H. K. Porter Company, in charge of all manufacturing and sales activities of the division. Mr. Sweeny joined Watson-Stillman in 1944 as controller, and at the



R. S. Sweeney

time of his recent promotion was vice-president and treasurer.

Jackson Kemper, has been appointed general manager of the Watson-Stillman fittings division. Mr. Kemper will be responsible for all operating and sales activities of the division, formerly known as the Watson-Stillman distributor products division, of which he was sales head.

THOMAS A. EDISON INC.—E. Woodward Allen has been elected vice-president of Thomas A. Edison, Inc. Mr. Allen will work as assistant to George E. Stringfellow, vice-president and manager of the



E. Woodward Allen

storage battery division. Daniel B. Mugan, field engineer specializing in railroad service applications for the Edison Storage Battery division, has retired after more



You don't have to stock a lot of different cleaners for a wide variety of railroad cleaning operations. For every one of the jobs indicated above, you can get faster, better and lower cost cleaning with just ONE specialized railroad cleaner.

Stock JUST ONE MATERIAL for All These Jobs!

Magnus 5RR is very different from ordinary soaps and powders. It is both a detergent and a solvent, that works just as well in cold as in hot water. You use very little 5RR to make a cleaning solution (about a teaspoonful to a gallon of water). It rapidly penetrates oily, greasy dirt deposits, dissolves the oil and grease, and leaves surfaces bright, clean and streakless.



DEODORIZ AND DISINFECT AT THE SAME TIME

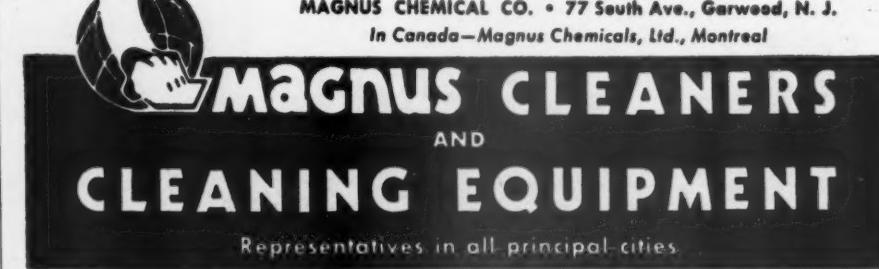
The ingredients in Magnus 5RR deodorize and disinfect as they clean. Yet they are harmless to all good paints and varnishes, and mighty easy on the hands. Magnus 5RR cuts down materially on cleaning labor time, because of its fast action and elimination of heavy manual scrubbing.

PUT IT ON THE JOB FOR A MONTH

Order a drum of Magnus 5RR. Use it for 30 days according to our recommendations. If, at the end of that time, you are not completely satisfied, send the unused material back and we will cancel the full invoice.

Railroad Division

MAGNUS CHEMICAL CO. • 77 South Ave., Garwood, N. J.
In Canada—Magnus Chemicals, Ltd., Montreal



Pioneers in
FULL QUALITY CONTROL

from raw materials through every step of production to the finished product.

STACKPOLE CARBON COMPANY, St. Marys, Pennsylvania

STACKPOLE

Diesel Brushes

than 36 years of continuous service with the division. John McDonnell, field engineer for the division since 1937, has been appointed to succeed Mr. Mugan.

Mr. Allen joined the Edison storage battery division in 1923. He was appointed sales engineer the following year and manager of engineering in 1939. In addition to his engineering duties, he assumed those of director of market research early in 1952.

C & C BATTERIES, INC.—Charles F. Weil, has been appointed regional manager, railroad sales, for the general Chicago district, handling heavy duty batteries, including locomotive diesel, car-lighting and air-conditioning. Mr. Weil will maintain headquarters at 3454 West Lake street, Chicago 24.



C. F. Weil

Mr. Weil is secretary of the Committee of the Coordinated Associations, and secretary and treasurer of the Allied Railway Supply Association. He is also active in the Western Railroad Club, the Car Foremen's Association, and the Chicago Diesel Club.

EQUIPMENT RESEARCH CORPORATION—F. R. Brookmeyer has been appointed vice-president of the Equipment Research Corporation, Chicago. Mr. Brookmeyer formerly was sales manager for the Mars Signal Light Company.

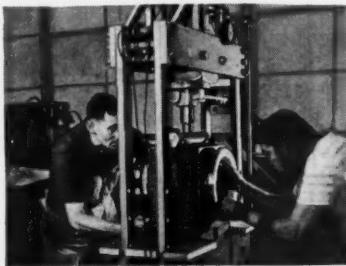
PYLE-NATIONAL COMPANY—The Pyle-National Company has opened a new district sales office in Milwaukee, at 743 North 4th street. George R. Adams, who joined the company in 1941, has been appointed district representative.

SPEER CARBON COMPANY—John S. Speer, II, has been appointed sales manager of the Speer resistor and Jeffers electronics divisions of the Speer Carbon Company, St. Marys, Pa.

GLASS FIBERS, INC.—Francis W. McPeek of Glass Fibers, Inc., Toledo, has been appointed manager of railway sales. Before joining Glass Fibers, Mr. McPeek was with Owens-Corning Fiberglas Corporation from its inception in 1935. During that period he served in various administrative and managerial capacities associated with railway sales and other national accounts.



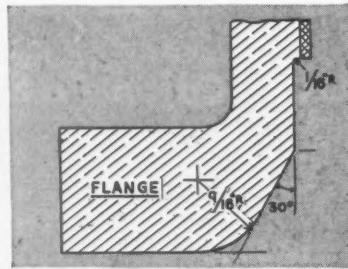
Here's why you can be sure of EXTRA TROUBLE-FREE MILEAGE with Magnus Traction Motor Support Bearings



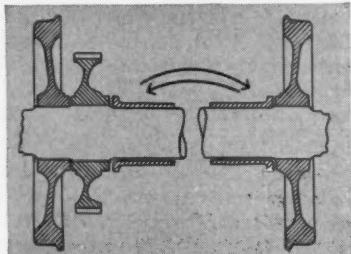
Perfectly Mated Bearing Halves are precision tested *under load*, to make sure that each bearing half takes only its fair share of the load.



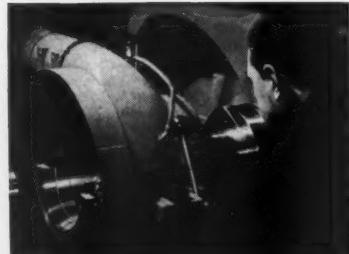
Satco Lining Metal, centrifugally applied, gives greater resistance to wear and load—stands up longer at elevated temperatures.



Improved Flange Fillet Profile prevents riding of the fillet or feathering of the lining metal—in standard or step sizes.



Interchangeable Double Keyway—a Magnus pioneered improvement that enables bearings to be used on either commutator or pinion shaft end.



Precision Finish Boring and close tolerance machining to rigid specifications give Magnus bearings unequalled quality and uniformity.



True Tested Hi-Strength Backs cast from high-tin, fine-grained wearing metal mixes that are *Magnus-guaranteed*.

TODAY'S trend to higher mileage between motor overhauls calls for an extra factor of safety in the road life of traction motor support bearings. And that's just what you get in Magnus HIGH MILEAGE bearings.

Each of the six Magnus features shown here is an important contribution to trouble-free bearing performance. Put them all together and you'll understand why it is that these precision-made bearings are setting mileage records in Diesel locomotives the country over.

Magnus HIGH MILEAGE Traction Motor Support Bearings are now available for replacement on all types and makes of Diesel and electric locomotives and MU cars. For the complete story, get your free copy of Bulletin No. 6000. Just write a post card or letter to:

Magnus Metal Corporation, 111 Broadway, New York 6, N. Y.; or 80 E. Jackson Blvd., Chicago 4, Ill.



MAGNUS
High Mileage

TRACTION MOTOR SUPPORT BEARINGS

...for every type and make of diesel locomotive

MAGNUS METAL CORPORATION Subsidiary of **NATIONAL LEAD COMPANY**

PITTSBURGH CORNING CORPORATION.—*E. H. Martin, Jr.*, has been appointed manager of Foamglas low temperature insulation sales for the Pittsburgh Corning Corporation. Mr. Martin joined the company in 1949 and has worked as assistant manager, Foamglas industrial insulation sales, and as manager of Foamglas building insulation sales.

AMERICAN WHEELABRATOR & EQUIPMENT CORP.—The district office of American Wheelabrator in New York has been moved to 53 Newark Street building, Hoboken. Sales engineers *David Logan*, *K. E. Blessing*, and *F. J. Pichard* are assigned to the

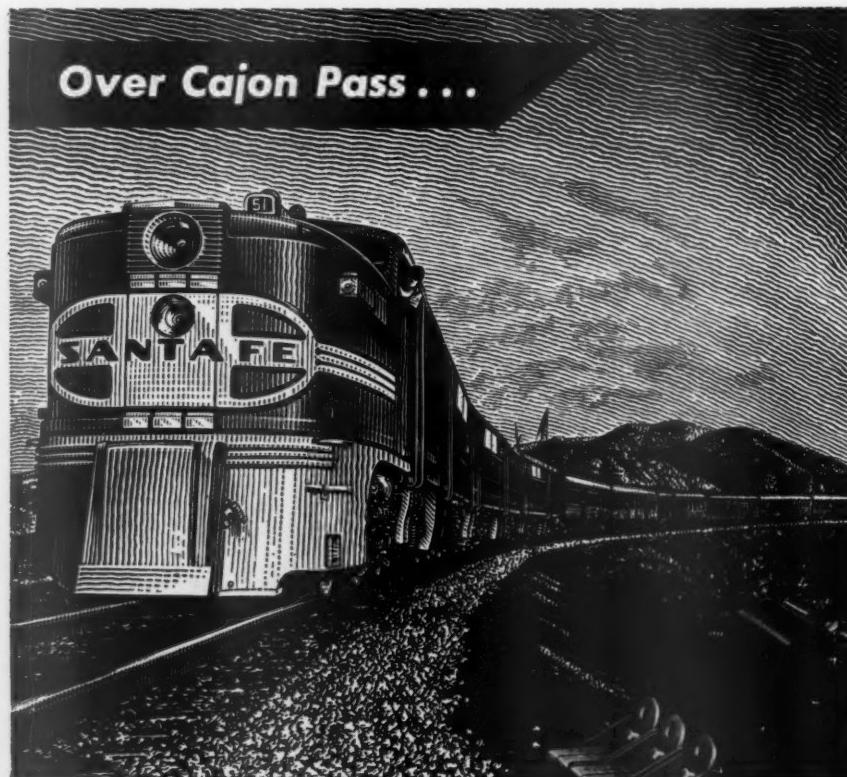
district, which includes portions of Pennsylvania, New York, Connecticut and New Jersey.

SHERWIN-WILLIAMS COMPANY.—*A. V. Higgins* has been appointed manager of the western transportation zone of the Sherwin-Williams Company. Mr. Higgins, who formerly headed national account sales in the western region, will continue to maintain headquarters in Chicago.

FARR COMPANY.—*John S. Powell* has been appointed division sales manager, supervising the Central division of the Farr Company, Los Angeles.

GRAYBAR ELECTRIC COMPANY.—*G. T. Marchmont*, southwestern and Gulf coast district manager for the Graybar Electric Company, has retired after more than 44 years with the organization. He is succeeded as southwestern district manager by *V. A. Elmblad* and as Gulf coast district manager by *J. E. Fontaine*.

ALBI MANUFACTURING COMPANY.—*C. A. Richardson*, who has been appointed exclusive representative and distributor to railroads, their subsidiaries, and associated industries, for fire-retardant coatings made



Over Cajon Pass . . .

. . . with FELPAK Lubricators helping maintain fast schedule

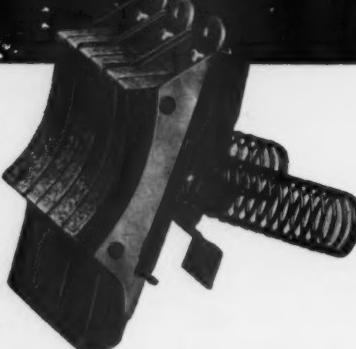
Tough hauls plus high speeds combined in the Santa Fe route through Cajon Pass demand dependable equipment.

That's why FELPAK lubricators are used to provide dependable suspension bearing lubrication. With the first turn of the wheels, and at high speeds, the bearings receive full lubrication through special felt wicks that last for thousands of miles. Old fashioned yarn packing that caused waste grabs and starved bearings is eliminated.

Your suspension bearing lubrication problems can be solved, too, with modern FELPAK Lubricators.

For full information on modern FELPAK Lubricators see your locomotive builder or write to:

MILLER FELPAK CORPORATION
WINONA, MINNESOTA



the lubricator
that eliminates
repacking



C. A. Richardson

by the Albi Manufacturing Company. Mr. Richardson will maintain headquarters at 332 South Michigan avenue, Chicago. He formerly was chief engineer of refrigerator car research for the Association of American Railroads.

EVERSON ELECTRIC COMPANY.—*Fred L. Keller*, general manager, has been elected vice-president of Everson. *Paul W. Rubrecht* has been appointed supply department man-



F. L. Keller

ager, and *David B. Everson* has been appointed sales promotion manager.

Mr. Keller is a graduate of Lafayette College (1920). He joined Everson in 1941 as a sales representative. He became sales manager in 1949 and General manager in 1951.

PRESSED STEEL CAR COMPANY.—William L. Killen, formerly sales manager of the Chicago steel tank division of the Pressed Steel Car Company, has been appointed general manager of the division. Edward A. Schiele, formerly district sales manager for G. O. Carlson, Inc., has been appointed to succeed Mr. Killen as sales manager.

UNITED STATES' STEEL CORPORATION.—Clifford F. Hood has been elected president of the United States Steel Corporation to succeed Benjamin F. Fairless, who will continue as chairman of the board and chief executive officer. Mr. Hood has been elected also a member of the board of directors and of the finance committee. Harvey B. Jordan has been elected executive vice-president—operations. Walter F. Munford has been appointed president of the American Steel & Wire division.

Obituaries

PAUL M. GILLILAN, 62, locomotive sales engineer for the General Electric Company, died recently. Mr. Gillilan began his career at G.E. in 1916 as foreman in the testing department in Schenectady. In 1920 he



Paul M. Gillilan

joined the engineering department and from 1924 to 1937 was identified with engineering and sales of electric drive equipment for gas-electric cars. Since 1937 he had devoted his time entirely to railroad sales and applications of diesel-electrics.

LEOPOLD E. BLOCK, one of the founders of the Inland Steel Company, died November 11 in Chicago. Mr. Block was vice-president of the company from 1897 until 1919, and chairman of the board of directors from 1919 until 1940, when he became chairman of the finance committee. He held that position until last January, when he was named honorary chairman of the board.

GEORGE L. MAYER, who retired in 1949 as eastern district sales manager of the Duff-Norton Manufacturing Company, died recently.

KENDALL B. ROWELL, chief engineer of the American Locomotive Company, died on December 12. A photograph and sketch of Mr. Rowell's career appeared in the December 1952 issue of the *Railway Me-*

chanical and Electrical Engineer (page 112), Mr. Rowell having only been appointed to the position of chief engineer on November 5.

W. R. COWDREY appointed master mechanic at Newton, Kan.

Atlantic Coast Line

ERNEST D. BARNETT, acting master mechanic at Waycross, Ga., appointed master mechanic at Waycross.

Canadian National

A. T. G. WESTBROOK, chief metallurgist, appointed assistant controller of tests and materials research in the research and development department at Montreal.

PERSONAL MENTION

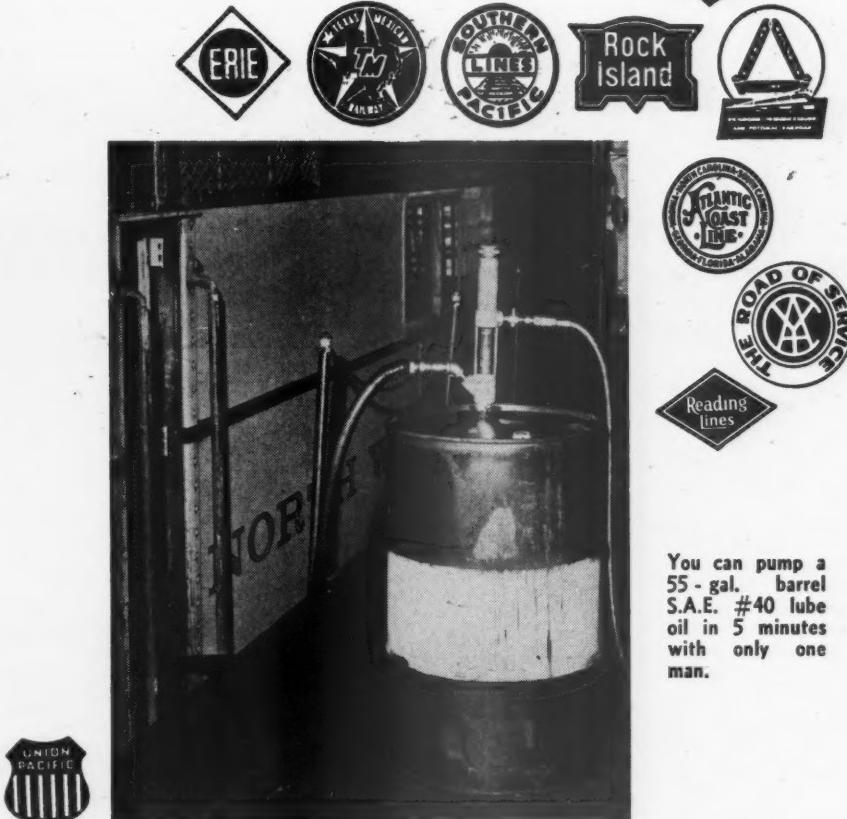
Atchison, Topeka & Santa Fe

W. A. BIRCH, master mechanic at Newton, Kan., has retired.

Wilkinson

High Speed Diesel Lube Oil Transfer Pump

REDUCE your Diesel lube oil handling time by more than 41% and eliminate oil spillage. Use the WILKINSON lightweight air-operated transfer pump. Only weighs 15 lbs. and no air enters drum or oil.



You can pump a 55 - gal. barrel S.A.E. #40 lube oil in 5 minutes with only one man.

Can furnish ready-to-use, — package consisting of WILKINSON Transfer Pump, 35 feet of $\frac{3}{4}$ " oil hose, and automatic shut-off valve.

HUDSON 3-5221

WILKINSON EQUIPMENT & SUPPLY CORP.

6958 South Wentworth Avenue, Chicago 21, Illinois



Only Genuine

RIDGID

PIPE WRENCHES

**Guarantee you against wrench
housing trouble and expense**

Look for the wrench with that guarantee label to make sure you get the extra-easy work and extra durability that have made RIDGID the world's most popular wrench.

Only RIDGID assures you a hookjaw that always rides freely in the housing; adjusting nut always spins easily to pipe size. Replaceable alloy jaws won't slip or lock on pipe. Handy pipe scale on hookjaw. Safe stout comfort-grip I-beam handle.

Save work and money—buy genuine RIDGIDs at your Supply House.

THE RIDGE TOOL COMPANY, ELYRIA, OHIO



**YEARS OF
DEPENDABLE
SERVICE!
UNDER ALL CONDITIONS**

**PROVEN IN
LEADING RAILROADS'
DIESEL SERVICE SHOPS**

STICHT HAND TACHOMETERS

**WITH IMPROVED
OVERSPEED PROTECTION**

TYPE U, CATALOG NO. 303

5 Ranges - 1 Instrument

30-120 RPM
100-400 RPM
300-1200 RPM
1000-4000 RPM
3000-12,000 RPM } BY ROTATING RANGE SELECTOR

**FOR DETAILS WRITE FOR BULLETIN NO. 750-LC
IMMEDIATE DELIVERY ... WHY WAIT?**

HERMAN H. STICHT CO., INC.

27 PARK PLACE,
NEW YORK 7, N.Y.

Tachometer Headquarters

SWEENEY PORTABLE MODEL 1100 TACHOMETER TESTER

ACCURATELY TESTS

ALL MAKES OF

**PORTABLE TACHOMETERS
IN JUST A FEW SECONDS**

TESTS at SEVEN SPEEDS

**300, 500, 600, 720,
800, 1000, 1800 R.P.M.**



**JUST PLUG IT IN ON AC!
ACCURATE AS AN ELECTRIC CLOCK!**

Precision-built by the makers of the famous Sweeney **POWERFRENCH** Tools

B. K. SWEENEY MFG. CO., Denver 17, Colo. IR-5

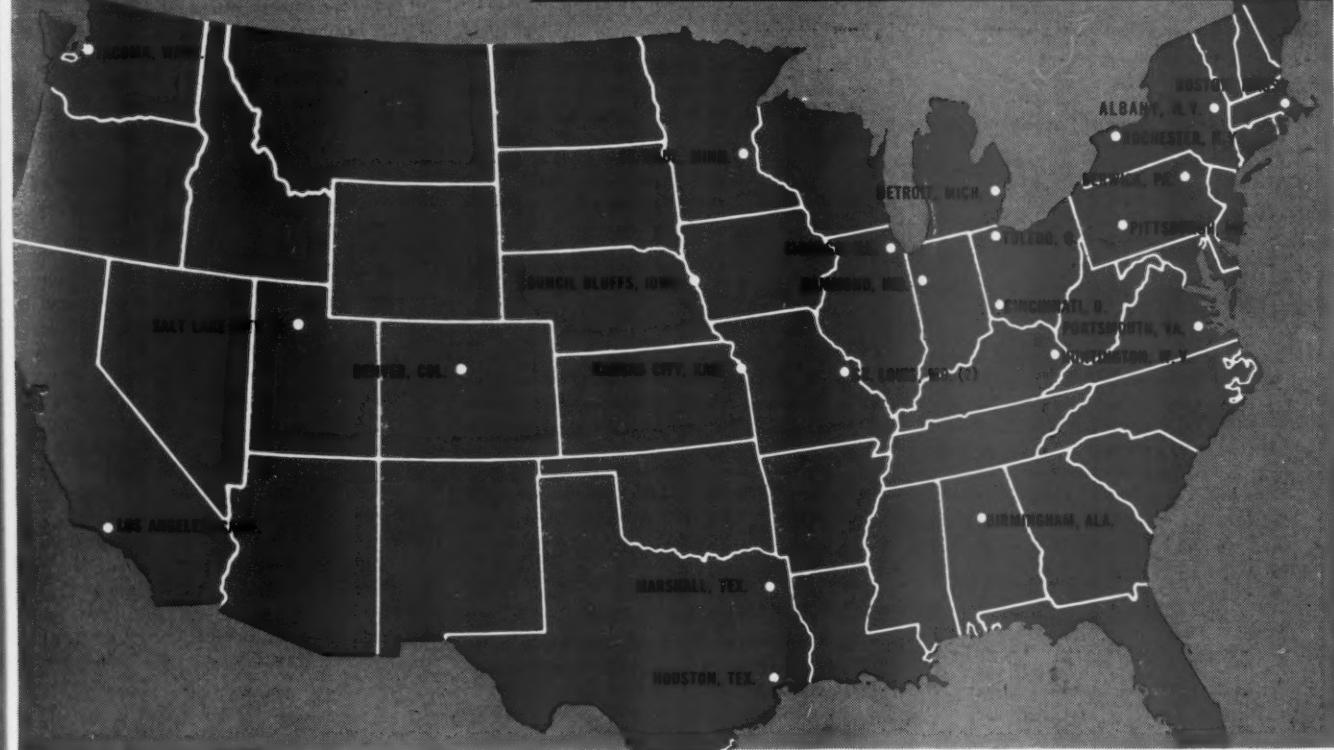
Please send full information on your Portable Tachometer Tester

Name _____

Address _____

City _____ State _____

QUICK, LOW-COST DELIVERY OF CHILLED CAR WHEELS FROM THE AMCCW PLANT NEAR YOU.



AMCCW Car Wheels save money for your railroad

coming *and* going

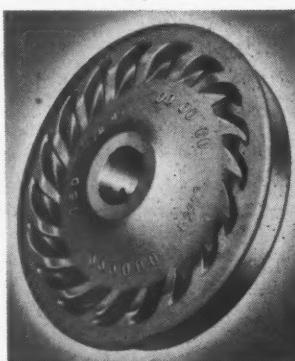
coming... When new car wheels are coming in, you'll find AMCCW wheels have the shortest haul, and consequently the quickest delivery. Chilled car wheel inventory can be kept to a minimum... and costly foreign line haul is usually eliminated.

going . . . You can ship worn wheels and other scrap conveniently to the nearby AMCCW plant, where it will be credited in exchange for new AMCCW wheels or bought at the going price.

coming and going... Chilled car wheels save money for your railroad by their low first cost, favorable exchange rates, easier shop handling; and by their high safety standards, plus the increased ton mileage they deliver.

THE IMPROVED CHILLED CAR WHEEL

**more brackets—thicker, heavier,
more continuous flange support; heavier tread
on both rim and flange sides.**



- In good supply
- Available locally
- Short-haul delivery
- Reduced inventory
- Low first cost
- Low exchange cost
- Increased ton mileage
- High safety standards
- AMCCW plant inspection
- Easier shop handling



ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

445 North Sacramento Boulevard, Chicago 12, Ill.

Albany Car Wheel Co. • American Car & Foundry Co.

Griffin Wheel Co. • Marshall Car Wheel & Foundry Co. • Pullman-Standard Car Mfg. Co.
Southern Wheel (American Brake Shoe Co.)

Chesapeake & Ohio

W. C. COX, electrical engineer at Grand Rapids, Mich., has retired.

W. P. CHESNEY, electrical foreman, appointed electrical engineer at Grand Rapids, Mich.

R. W. LLEWELLYN, general foreman-piers at Newport News, Va., appointed assistant master mechanic at Newport News.

W. H. MARSHALL, general foreman-piers at Newport News, Va., has retired.

H. C. GENTRY, foreman electrical equipment-piers at Newport News, Va., appointed general foreman-piers at Newport News.

W. E. GILSON, general foreman at Martin, Ky., has retired.

C. E. JENKINS, general foreman at Shelby, Ky., appointed general foreman at Martin, Ky.

Chicago & North Western

R. V. RENTSCH appointed diesel supervisor, with headquarters at Chicago.

R. A. KENNARD appointed diesel supervisor, Wisconsin and Madison divisions, with headquarters at Chicago.

R. C. GAETH appointed acting electrical supervisor, with headquarters at Chicago.

W. H. McAMIS appointed superintendent locomotive and car shops, with headquarters at Chicago.

H. R. SPENCER appointed division general foreman, Lake Shore, Ashland and Peninsula divisions, with headquarters at Green Bay, Wis.

D. W. ANDERSON appointed division general foreman, Iowa division, with headquarters at Clinton, Ia.

M. H. CRANDALL appointed division general foreman Lines West and Dakota division, with headquarters at Council Bluffs, Ia.

H. W. MITTMAN appointed division general foreman, Galena division and Southern District Galena division, with headquarters at Proviso, Ill.

R. E. QUINN appointed general car foreman, Erie street coach yard, Chicago.

L. V. LEAVITT appointed road foreman of engines, Wisconsin division, with headquarters at Chicago.

N. D. ARNOLD appointed road foreman of engines, Galena division, with headquarters at Proviso, Ill.

A. BEST appointed road foreman of engines, Galena division, with headquarters at West Chicago.

J. G. BRANDT appointed assistant road foreman of engines, Iowa division, with headquarters at Clinton, Ia.

F. E. McNERTNEY appointed assistant road foreman of engines, Iowa division, with headquarters at Boone, Iowa.

Chicago, Burlington & Quincy

O. E. WARD, superintendent of motive power of the Chicago, Burlington & Quincy will retire January 1.

Mr. Ward began his railroad career with the Chicago, Burlington & Quincy as a locomotive fireman in 1902. Subsequently he served as locomotive engineman and road foreman becoming assistant fuel supervisor in 1917. In 1919 he was promoted to assistant superintendent of motive power at Lincoln, Neb. In 1920 he was named air brake instructor and acting master mechanic. Two years later he was appointed assistant master mechanic at Galesburg, Ill. From 1923 to 1926 he was master mechanic at Alliance, Neb. He next served as superintendent of motive power at Lincoln until he was appointed to serve at Chicago in the same capacity in 1927. After his retirement at the beginning of the year he will accompany Ralph Budd, Chicago Transit Authority chairman, to Brazil to study transportation problems for the Brazilian government (Railway Age, December 8, page 14).

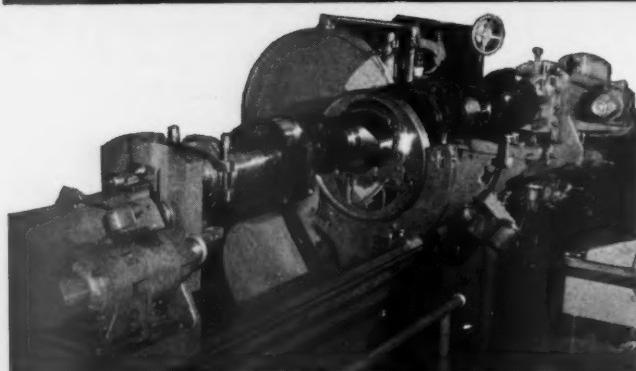
Florida East Coast

C. A. GAMMON, superintendent car department, appointed assistant chief mechanical officer, with headquarters at St. Augustine, Fla.

Born: Cedar Rapids, Iowa, on January 26, 1896.

Career: Entered railroad service with the New York, Chicago & St. Louis at Stony Island shops, Chicago, as stock clerk in the stores department, later transferring to the mechanical department. With the Illinois Central in the A.A.R. billing department at Chicago until November 17,

CRANKSHAFT GRINDING SERVICE



**Established 1924
... 28 years experience grinding crankshafts! The most complete engine rebuilding shop in the Southwest!**

THE LARGEST CRANKSHAFT GRINDING MACHINE IN THE WORLD USED IN AN INDEPENDENT REPAIR SHOP

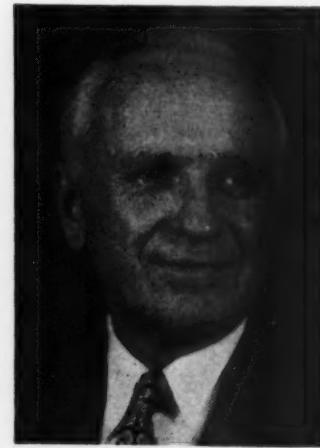
★ HARD CHROMIUM PLATING SERVICE ★ CRANKSHAFT STRAIGHTENING SERVICE ★ MAGNAFLUX SERVICE

Four machines giving range from the smallest up to crankshafts with stroke of 16" and 200" O.A.L. Complete grinding service for locomotive, stationary, marine, automotive and compressor crankshafts. Undersized journals restored to size by hard chromium plating.

NATIONAL WELDING & GRINDING CO.

2929 CANTON ST.

DALLAS 1, TEXAS



C. A. Gammon

1917, when he joined the Louisville & Nashville at its South Louisville, Ky., shops. In November, 1919, became piecework inspector with the Ryan Car Company at Hegewische, Ill. Mr. Gammon was general car inspector of the Missouri Pacific prior to entering the service of the FEC on August 1, 1925, as general car inspector. Appointed general car foreman of the Southern division at Miami on April 1, 1929, transferring to St. Augustine on July 1, 1931. Became superintendent car department there on December 1, 1951.

Grand Trunk Western

HAROLD W. ASKEW, shop superintendent at Port Huron, Mich., appointed assistant general superintendent of car equipment at Battle Creek, Mich.

Career: Began with the Canadian National in 1918 as an assistant tinsmith at



Harold W. Askew

London, Ont. Appointed assistant foreman of the car department at Montreal in 1936; foreman in 1938; general inspector of shop and methods in 1944, and superintendent of car shops at Port Huron in 1948.

QUENTIN R. LING, appointed superintendent of car shops at Port Huron, Mich.

Louisville & Nashville

J. F. ROUNTREE, assistant general foreman in the blacksmith shop at South Louisville, Ky., appointed general foreman, blacksmith shop.

J. D. CARLIN, general foreman, blacksmith shop, at South Louisville, Ky., has retired.

New York Central

V. F. KANIA appointed special inspector, Michigan Central district, with headquarters at Detroit.

C. R. HEMING, master mechanic at Jackson, Mich., has retired.

R. S. GATES, appointed master mechanic, with headquarters in Jackson, Mich.

Norfolk & Western

O. J. JENNINGS, wreckmaster at Crewe, Va., appointed car foreman at Crewe.

R. E. FLOYD, car foreman at Crewe, Va., appointed assistant car foreman at Lambs Point, Va.

RUFUS A. HENRY, JR., appointed assistant machine shop foreman at Roanoke, Va., shops.

ALBERT L. HALL, assistant car foreman at Lambs Point, Va., has retired.

D. L. GRUBB, machine shop assistant foreman at Roanoke, Va., shops, has taken over the duties of C. R. Coleman.

Pennsylvania

REX R. MCKINNEY, appointed superintendent motive power of the Central region at Pittsburgh.

Born: Tyrone Forge Pa.

Education: Graduate of Pennsylvania State College (1927).

Career: Entered railroad service as a shop hand on the PRR in 1920. In 1929, appointed motive power inspector at Altoona Works, and in 1947, after serving in various capacities, became master mechanic at Renovo, Pa., subsequently transferring to Harrisburg. In 1950, appointed superintendent locomotive shop, Altoona Works.

W. P. BICKLEY, master mechanic, New York division, appointed assistant superintendent motive power, Eastern Region, with headquarters at Philadelphia.

W. H. YARBER, master mechanic, Lake division, at Cleveland, appointed master mechanic, Pittsburgh and Conemaugh divisions, with headquarters at Pitcairn, Pa.

J. C. WHITE, assistant master mechanic, Eastern division, appointed master mechanic, Lake division, with headquarters at Cleveland.

R. M. HOLCOMB, assistant master mechanic, New York division, appointed master mechanic, New York division.

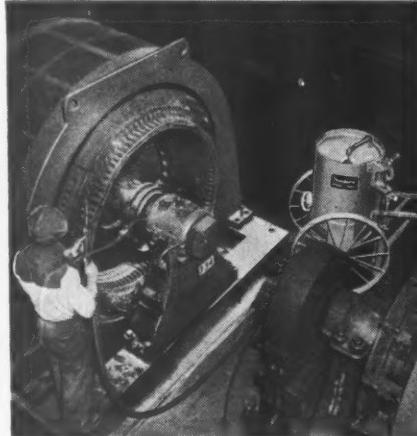
D. B. OWENS, appointed assistant master mechanic, Eastern division.

C. M. STEWART, foreman, special duty, office general superintendent motive power

Pangborn SAVES

**90.9% on materials
66.7% on labor
in cleaning motors!**

. . . reports user of Pangborn
Corn Cob Blast Machine



Cleaning Duplicate 500 hp Synchronous Motors

	Material	Labor
Solvent Method	\$55.00	120 hrs.
PANGBORN Method	5.00	40 hrs.
SAVING	50.00 (90.9%)	80 hrs. (66.7%)

Remarks: With Solvent, drying period took on additional 8 hours.

- ACTUAL cost-time records prove that the portable Pangborn AC-4 "Corn Cob" Blast Machine scourts armatures, parts, frames, coils, etc., in $\frac{1}{3}$ the time of other methods.
- In addition, materials and labor costs are drastically cut, toxic dangers are eliminated, and there's no waiting for parts to dry.
- Soft, 20-mesh corncob grits do the job with 40-lb. air pressure, whisking away grease, oil, paint flakes, etc.
- FOR FULL INFORMATION on how the Pangborn AC-4 can help you, write us and tell us what you clean. Address: PANGBORN CORP., 3700 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the latest developments
in Blast Cleaning and Dust Control equipment

Pangborn

**BLAST CLEANS CHEAPER
with the right equipment
for every job**

APEX INSERTED-BLADE METAL-CUTTING TOOLS

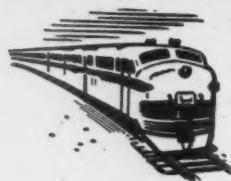
FOR LOCOMOTIVE AND CAR MAINTENANCE

Adjusted Serrated Style

for axle jobs. One of many types of railroad shop cutting tools available promptly from stock.

**WRITE
FOR
CATALOG**
APEX TOOL & CUTTER CO., Shelton 21, Conn.

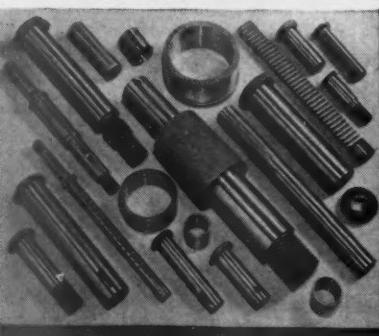
■ Order EX-CELL-O ■ Pins and Bushings ■ From Stock!



**FOR LOCOMOTIVES,
PASSENGER
AND FREIGHT CARS**

If your railroad pins and bushings are among Ex-Cell-O's wide range of standard sizes, you can save money and expedite delivery by ordering directly from stock. You'll get highest quality materials and workmanship, as evidenced by the fact that more than 200 railroads and equipment builders depend on Ex-Cell-O for hardened and ground steel pins and bushings. Order them directly from the convenient Ex-Cell-O Catalog.

For a complete listing of standard Ex-Cell-O Pins and Bushings for Diesel and steam locomotives and passenger car equipment, write for new Ex-Cell-O Bulletin 32428.



RAILROAD DIVISION
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



XLD

Shows Railroad Freight Capacities at a Glance!

U. S. RAILROADS MAP

Prepared by
PROFESSOR EDWARD L. ULLMAN
UNIVERSITY OF WASHINGTON

- ✓ CLASSES ROADS BY LOAD CAPACITIES
- ✓ SIZED 34x44 INCHES FOR WALL OR DESK USE
- ✓ PRINTED IN 3 COLORS, FOR EASY READING
- ✓ ACCURATE, COMPREHENSIVE, MODERN

A Unique Idea in Maps

You'll certainly want a copy of this remarkable map of U. S. railroads. Nothing like it has ever been devised. Prepared under the direction of Professor Edward L. Ullman, University of Washington, it combines the unique advantages of a map with the simplicity and information of a graph. It shows you U. S. railroads from an entirely different and important viewpoint.

Classifies Roads by Capacities

Consider the convenience of having reliable information of this sort instantly available. A glance at the map shows you all major U. S. railroads divided into these six classifications: three and four track roads, double track roads, single track roads with centralized traffic control, single track roads with automatic signal installations, other important single track roads, all other trackage. Electrification is also shown. In every case, carefully verified data were used. Thus, the map is not only the first of its kind, but also one of the most modern and accurate U. S. railroad maps available.

Size, Color Make Map Easy to Read

Nearly three feet high by four feet wide, the map is ideally suited for display and use on wall or desk. Trackage is shown in dark blue; railway names, state boundaries, and major cities in grey; water areas in light blue; and special symbols in red. The combination of size and three-color printing on white paper makes it simple for you to tell instantly the traffic potentialities of roads in any section of the United States. The research, the expert knowledge, the painstaking labor, and expensive production represented in this map make it an outstanding value at only \$2.50. Once you experience the convenience of using it, you'll say it's the most useful map you've ever owned. Order yours today.

FREE EXAMINATION COUPON

Railway Locomotives and Cars, Dept. I-53
30 Church St., New York 7, N. Y.

Please send me for free examination a copy of U.S. RAILROADS MAP. If after 10 days I am not completely satisfied I will return the map and owe nothing. Otherwise, I will remit the price of \$2.50 plus a few cents for postage and handling.

Name

Street

City, State

International

THERE'S A NEW PRECISION IN FREIGHT CAR CONSTRUCTION

THE INTERNATIONAL UNDERFRAME

A much sturdier underframe incorporating a maximum utilization of material section with minimum weight.



THE ALL-PURPOSE BULK-LADING DOOR

Requires no inside grain door . . . and has an access door for loading, inspection and sampling. Positive retainment on the car structure.



ALL-WELDED CAR SIDES

Delivered ready to assemble, to car owners who assemble their own cars. Maximum welded attachment to the side plate and side sill upper elements.



THE RACE IS TO THE SWIFT... In today's race to step up schedules, rush cars through the yards and maintain higher speeds on the line, the job is to deliver the goods faster!

...THE BATTLE TO THE STRONG! In order to set and maintain such a pace, railroads must keep construction techniques abreast of schedules. Cars must be as well constructed to withstand these new speeds as motive power is to deliver them!

International Steel Company—by diligent research and faithful adherence to proper design and construction techniques—has developed the necessary ingredient to successfully meet today's problems—precision construction based on true conceptions.

INTERNATIONAL STEEL COMPANY RAILWAY DIVISION
EVANSVILLE 7, INDIANA

at Chicago, appointed assistant master mechanic, New York division.

H. F. STEDING, assistant road foreman of engines, Panhandle division, at Dennison, Ohio, appointed assistant road foreman of engines, Lake division, with headquarters at Cleveland.

D. D. WRIGHT, assistant road foreman of engines, Lake division, at Cleveland, appointed assistant road foreman of engines, Eastern division, with headquarters at Pittsburgh.

J. A. PARK, special duty engineman, Lake division, appointed assistant road foreman of engines, Panhandle division, with headquarters at Dennison, Ohio.

Southern

RICHARD E. FRANKLIN, master mechanic at Birmingham, Ala., appointed superintendent of maintenance equipment, with headquarters at Charlotte, N. C.

CECIL D. SCHWINE, JR., assistant master mechanic at Birmingham, Ala., appointed master mechanic at Birmingham.

WALTER G. SCHWEINEBRATEN, general foreman at Somerset, Ky., appointed assistant master mechanic at Birmingham, Ala.

EARL A. HEDGEPAATH, general foreman car repairs at Richmond, Va., appointed assistant to master mechanic at Spencer, N.C.

HAYNE K. CHATHAM, appointed road foreman of engines at Spencer, N.C.

WILLIAM E. HAYNES, appointed foreman boiler shop at Chattanooga, Tenn.

EDWIN L. THOMPSON, appointed gang foreman car repairs at Greensboro, N.C.

HAMILTON E. WITHERS, JR., appointed assistant foreman enginehouse at Spencer, N.C.

Union Pacific

C. R. SMITH, master mechanic, Memphis division, and of the Union Railway of Memphis, has retired after 41 years of service.

C. H. MCAMIS, master mechanic at Monroe, La., appointed master mechanic, Memphis division.

A. J. DANIEL, appointed master mechanic at Kansas City, Mo.

E. M. VANDIVER, master mechanic at Kansas City, Mo., appointed master mechanic at Monroe, La.

Seaboard Air Line

H. S. MERCER, appointed chief mechanical officer at Norfolk, Va., as announced in the December issue.

Born: Savannah, Ga., on November 9, 1902.

Career: Entered railroad service on October 25, 1919, as a machinist apprentice

with the SAL at Savannah. Subsequently served as machinist, roundhouse foreman at Savannah and Hamlet, N. C., and general foreman at Howells, Ga., and Raleigh, N. C. Appointed master mechanic at Howells in May, 1943; shop superintendent



H. S. Mercer

in the locomotive department at Jacksonville, Fla., in November, 1947; assistant chief mechanical officer at Norfolk in August, 1949, and acting chief mechanical officer at Norfolk April 1, 1952.

PERSONAL MENTION—Obituary

FRANK J. JUMPER, retired general mechanical engineer of the Union Pacific, died October 30. Mr. Jumper was a graduate of Rose Polytechnical Institute at Terre Haute with a Bachelor of Science degree in electrical engineering. He joined the Union Pacific in 1905 as an assistant mechanical engineer at Omaha. He became mechanical engineer of the McKeen Motor Car Company at Omaha in 1909, later being appointed general manager. Mr. Jumper resumed his railroad career in 1920 as general manager of the UP's motor-car department. He served consecutively as chief draftsman, engineer of inspection, and assistant general mechanical engineer. In 1937 he was appointed general mechanical engineer.

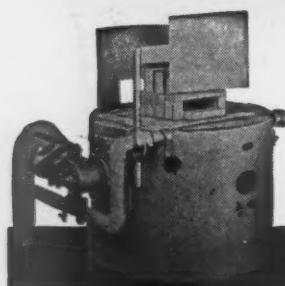
New Devices

(Continued from page 94)

tional Grade DE-3 brush is a product of a new, scientific approach to the problem of special purpose brushes particularly designed to meet the severe operating demands of diesel-electric traction motor service. It has been tested in both freight and passenger service under difficult operating conditions on seven Class I railroads, covering a total of more than 7½ million motor miles.

The brush has given exceptionally long service life. Three features claimed for the brush are increased mechanical strength, reduced friction and permanently sealed shunt connections. These qualities, it is

Full Fire INSTANTLY Without Smoke ... with a JOHNSTON



Oil Burning BLACKSMITH FORGE!

SAVE TIME with a Johnston Blacksmith Forge! Eliminate costly lost time in handling coal and ashes. Parts are easily and quickly positioned, and removed for inspection.

Increase production—lower costs with a new Johnston Oil Burning Blacksmith Forge!

ASK FOR CATALOG R 301
OVER THIRTY YEARS EXPERIENCE IN FURNACE DESIGN AND MANUFACTURE
BURNERS—BLOWERS—FURNACES—RIVET FORGES—
FIRE LIGHTERS—TIRE HEATERS

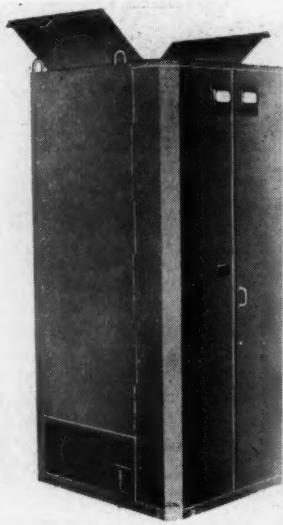


JOHNSTON

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

said, result in longer life, greater dependability and substantially lower brush and maintenance cost-per-mile.



Load Tester for Diesel Locomotives

A standardized loading resistor for load-testing the power plants of diesel-electric locomotives rated up to 2,500 hp. is available from the Westinghouse Electric Corporation.

This loading resistor, type TT-148, is a self-contained, compact unit that consists of 12 resistor trays, a motor-driven blower, knife switches, and measuring instruments. It is 42 in. wide, 46½ in. 104½ in. high, and weighs 3,500 lb.

The resistor sections are connected through knife switches and bus bars that make possible ten different series-parallel combinations to give 10 load points. Resistor elements are mounted to provide maximum surface cooling and have slip-joint supports to allow expansion under load. Individual resistors can be replaced without disturbing adjacent elements.

The blower motor, which is mounted vertically at the base of the structure, is part of the resistor circuit, so no external source of power is required.

Copper-Clad Steel

Copper-clad steels, combining the advantages of copper and steel in plate form, is now available for use in industrial equipment. Product of Lukens Steel Company, Coatesville, Pa., the material consists of a layer of predetermined thickness of copper permanently bonded to one side of a carbon steel backing plate. It is a good heat transfer material.

The corrosion resistance of copper, combined with the rigidity and strength of steel, makes the product suitable for use in evaporators, condensers, tube sheet, heat exchangers, hot water heaters and pressure vessels.

The manufacturer states that copper-clad

steels simplify problems of equipment design and aid in reducing fabrication time. For many types of equipment, a smaller thickness serves the same purpose as a thicker section of solid copper.

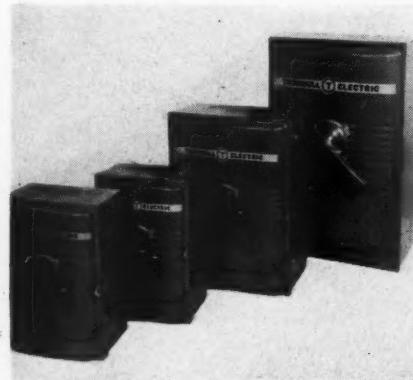
These steels are furnished in plate form in sizes up to 120 in. in width; or 380 in. in length and in thicknesses from $\frac{3}{16}$ to 1½ in. Cladding percentages can be 10, 15 or 20 per cent. The product can also be furnished in the form of Heads, Flanged Only, Standard Flanged and Dished, ASME Flanged and Dished and Elliptical Dished Heads.

Two Spindle Drilling Machine

Improvements in design for its 2-spindle, 20 in. swing, Model MC-20 drilling machine have been announced by Sibley Machine & Foundry Corp., South Bend 23, Ind.

A sturdier column and heavier base are incorporated in the new design to provide the rigidity required for the unit's capacity of 1½ in. drilling in mild steel. Coupled with its sensitivity for small size drills, recommends it for a variety of production and maintenance drilling jobs.

Incorporated into the device is a dial indicator that can be used for easy selection of geared power feeds and to step up operator efficiency. A spring-loaded lever for changing the 8-spindle speeds of 65 to 1,360 r.p.m. cuts operator time.



Safety Switches

Immediate availability of a new 200-amp., 600-volt, fusible and no-fuse front-operated safety switch has been announced by the Trumbull Electric Department of the General Electric Company, Plainville, Conn. This switch rounds out the line of similar 30-, 60-, and 100-amp. switches previously developed by this company. All of the switches are now equipped with a felt gasket which blocks dust and dirt in much the same manner that weatherstripping stops drafts.

The arc-quenching action of this switch is patterned after the arc-interrupting principle of modern circuit breakers. The double-break, visible contacts are opened and closed at high speed. Grid pins break up the arc, divide it into a series of smaller arcs, and dissipate the heat.

SHORTCUTS to better commutator maintenance

QUALITY-BUILT
TO DO THE JOB
RIGHT! . . .

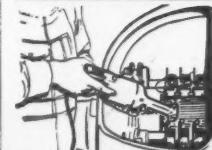
The easiest way to restore commutators in traction motors and generators without dismantling during interim maintenance...or during periodic overhauls. IDEAL Resurfacers and other tools are used by leading railroads and recommended by locomotive builders.

RESURFACERS



Refinish commutators to like new condition even when ridged, scored or burned. Wood block handles clamp rigidly into grinder. Seven sizes, in all grades from extra coarse to extra polish.

MICA UNDERCUTTERS



Work easily in close quarters. Several models. Direct drive or by flexible shaft.

For use with IDEAL Commutator Saws and Milling Cutters.

FLEXIBLE ABRASIVE

Cleans and burnishes commutators. Non-dusting. Complete size range.

CLEANER-BLOWERS



Blows air at high velocity and harmless low pressure. Lightweight and rugged. May also be used as a vacuum cleaner or sprayer. Three models: $\frac{1}{2}$, $\frac{3}{8}$ and $1\frac{1}{2}$ H.P.

FREE 39-page Handbook
Complete information on
commutator maintenance.
Mail coupon.

IDEAL Products Are Sold through
Leading Distributors

IDEAL INDUSTRIES, Inc.

1563 Park Avenue, Sycamore, Illinois



Send FREE Handbook and catalog sheets on:

Resurfacers Flexible Abrasive

Undercutters Cleaner-Blowers

Name _____

Title _____

Company _____

Address _____

City _____

Zone _____ State _____

Got New Diesels? Then Your Crews and Mechanics Need This New Book!

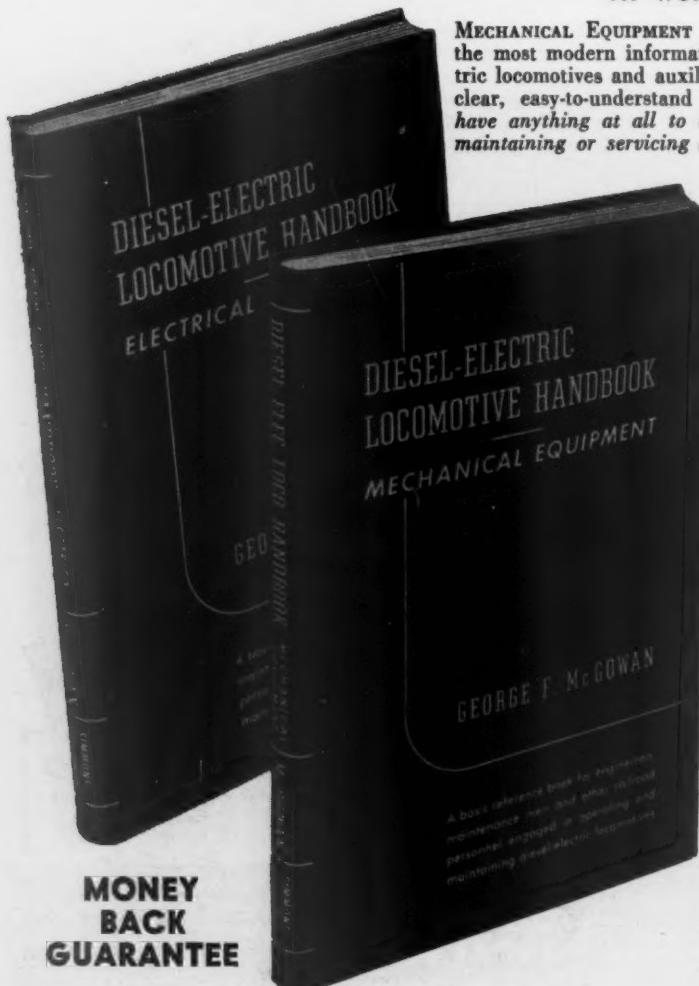
DIESEL-ELECTRIC LOCOMOTIVE HANDBOOK

By GEORGE F. McGOWAN, Technical Consultant

SEND TODAY for this great new book! Packed with photos and diagrams, it brings you up-to-the-minute facts—the latest available on diesel-electric locomotives and equipment. Here is everything you need and want to know—written from the viewpoints of the men in the cab and the shop—by an experienced railroad man—all checked and approved by the leading locomotive builders. For your convenience this handbook is sold separately in two volumes: Mechanical Equipment and Electrical Equipment. Read the descriptions that follow and you'll agree: *Here is essential information you cannot afford to be without!*

MECHANICAL EQUIPMENT

Everything necessary to complete understanding of diesel-electric locomotives is included—how diesel-electric locomotives are constructed, the reasons behind their design, proper operating methods, things that can go wrong with them, "trouble-shooting," and effective servicing and maintenance.



MONEY
BACK
GUARANTEE

GIVES YOU FULL DETAILS OF EACH PART

Among the chapters are: The Development of the Diesel-Electric Locomotive; Fundamentals; Lubricating and Cooling; Fuel Systems—Fuel; Pistons, Piston Rings, Liners; Connecting Rods, Bearings, Crankshafts; Valves, Timing, Heads; Governors; The Steam Generator; The Air Compressor; and The Gas Turbine Locomotive.

DESCRIBES EACH LOCOMOTIVE BY MAKE

Separate chapters are devoted to accounts of diesel engines made by The American Locomotive Company, Baldwin Locomotive Company, Electro-Motive Diesel, Fairbanks, Morse & Company, and Lima-Hamilton Corporation. Each engine, its parts, and its non-electrical auxiliaries are described and illustrated in full detail.

SOLVES PROBLEMS YOU MEET AT WORK

MECHANICAL EQUIPMENT provides you with the most modern information on diesel-electric locomotives and auxiliary equipment, in clear, easy-to-understand language. If you have anything at all to do with operating, maintaining or servicing diesel-electric locomotives, you'll use this book as a handbook to help you solve problems that you meet in your daily work, and as a reference to keep you on top of developments in this expanding field.

ELECTRICAL EQUIPMENT

You get full descriptions of all major pieces of electrical equipment and all their parts: how they are constructed, how to operate them, how to take care of them and how to fix them if they go wrong.

There are chapters on: The Electric Generator; The Traction Motor; Exciters, Auxiliary Generators, Motor Blowers, Dynamic Braking; Batteries; and Contactors.

DETAILS EQUIPMENT INDIVIDUALLY BY MAKE

The electrical and control equipment of the major builders: Alco-G.E., Electro-Motive Division, Lima-Westinghouse, Baldwin-Westinghouse, and Fairbanks, Morse-Westinghouse is completely analyzed in individual chapters.

REQUIRES NO SPECIAL ELECTRICAL KNOWLEDGE

You need only a layman's knowledge of electricity to gain the utmost benefit from this book—because the subject is presented in practical language by an experienced railroad engineer.

ANALYZES ELECTRICAL SET-UP STEP-BY-STEP

You learn why the electrical transmission has been adapted to the diesel locomotive; its advantages, disadvantages, and limitations. You get a review of electrical fundamentals; definitions of terms and explanations of how to use the most common electrical formulas. Schematic wiring diagrams are explained and their special symbols identified.

EXPLAINS OPERATION, SERVICING, MAINTENANCE

Yes, here is your opportunity to gain a complete understanding of the electrical equipment of today's diesel-electric locomotives, to learn how to handle the equipment, to equip yourself to service and maintain it.

Simmons-Boardman Books
30 Church St., New York 7, N. Y.
Enclosed find — for the book(s) checked below. I understand that you will ship them to me postpaid, and that if I am not completely satisfied I may return them any time within 10 days of receipt for a full refund of my money.

1/53

MECHANICAL EQUIPMENT, \$4.95

ELECTRICAL EQUIPMENT, \$4.95

COMBINATION OFFER — SAVE MONEY

Both volumes above, only \$9.75

Name

Street

City

State